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Physical Science.

Col. Reid's Law of Storms Examined. By JAMES P. ESPY.

(Continued from p. 158.)

Hurricane of the middle of Aug., 1837.—St. Augustine, 19th August, 1837. On Tuesday, the 15th August, we were visited by a third gale of wind, of equal severity with the two which preceded it, and which continued until the afternoon of Friday, 18th August, when it ceased.—American paper.

A severe Gale at Turks' Island on the 15th August.—From Lloyd's List Narrative of Mr. Wilkinson, master of the Calypso, in the storm of the middle of August, 1837.

"On the 15th August, noon, the Calypso was, by observation, in lat. 26° 47′ north, and lon. 75° 5′ west; the wind was from the eastward, about *east-north-east*; she had royals and foretopmast studding-sails set: shortly after we got a heavy swell from the north-eastward, and the wind gradually freshened till 9 o'clock, when only the double reefed topsails, reefed foresail, and mizen could be carried. During the night the wind increased, and at 10 next morning, the wind about N. E., the lee rail under water, and the masts bending like canes; got a tarpaulin on the main rigging, and took the maintopsail in; the ship labouring much, obliged main and bilge pumps to be kept constantly going. At 6 P. M. the wind *north-west*, I should think that the lat. would be about 27°, and lon. 77°.

"At midnight, the wind was *west*, when a sea took the quarter boat away. At day dawn, or rather I should have said, the time when the day would have dawned, the wind was *south-west*, and a sea stove the fore scuttle, all attempts to stop this leak were useless, for when the ship pitched, the scuttle was considerably under water. The wind, from about noon of the 16th, till about 10, or noon, of the 17th, blew with nearly the same violence. There was no lull; neither did it fly from one point of the compass to the other;

but backed from *east-north-east* to *south-west*, and then died away gradually.

"On Sunday, the 20th, while beating off Rum Key, the wind was variable and squally. On Monday, in lat. 24° 40′, lon. 74° 45′, we had fine steady winds from the eastward.

The Mary, Sharp, from New Orleans to Barbadoes, was abandoned on the 5th September, lat. 32°, lon. 80°, having been dismasted and thrown on her beam ends, with six feet water in her hold, in a gale on the 16th August, in lat. 27° 30′, lon. 73° 53′.

"The brig Yankee, on the 16th August, in lat. 24° 30′, lon. 70° 30′, experienced a severe gale of wind from the N. E. to S. W., which lasted till the 20th."—N. Y. General Advertiser.

The Rosebud, Dick, from Havana to London, was capsized and dismasted on the 18th August, in lat. 34° lon. 74°.

Wilmington Newspaper, Aug. 25.—"On the afternoon of Friday, the 18th, the wind shifted to the *north-east*, and rain began to pour heavily. Before midnight the storm increased, threatening ruin, &c. The tide rose six feet higher than usual."

The Westchester, from Havana, experienced a heavy gale *from the north-east*, on the 18th, and on the 20th, in lat. 32° lon. 74°.

The Maria, from Honduras to London, on the 20th Aug. in lat. 33° lon. 74°, capsized.

Log of Ship Sophia.—On P. M. of 15th, wind E. N. E., steady and moderate, with a heavy lowering; at 4 P. M. in topgallant sails and gaff topsail; at midnight do. weather; A. M. breeze freshening; at noon, strong breeze, with a very stormy appearance, the swell evidently increasing; latitude observed, 31° 37′, lon. per chronometer, 74° 54′ 30″, barometer at fair.

P. M. of 16th. Wind N. E. by E., steady; the sky loaded, to the eastward, with heavy, sluggish clouds, and apparently no distance over head; at 8 P. M. down royal yards; at 6 breeze freshening—at midnight strong gale, with high cross sea, the mercury much agitated and inclined to fall. At 6 A. M. of the 17th, set the foresail again, at noon very hazy round the horizon, with the appearance over head as yesterday; lat. 33° 3′, lon. 75° 9′, barometer fallen to change.

P. M. Wind E. N. E., with the same wild appearance, and every indication of a dangerous change of weather; at 3 P. M. wore ship to southward, barometer still falling, wind E., gale increasing; at daylight of 18th, in fore and maintopsails, &c. At noon heavy gale of wind E. S. E., the sky as if closing around us, and having a most dismal appearance; barometer from stormy to change.

P. M. Heavy gale with violent squalls and rain, wind S. S. E. At 6 P. M. blowing a hurricane—wind S. S. E. Same weather continued till midnight of the 19th. On the morning of the 20th, the wind backed gradually to the northward, with no abatement, and at noon the wind was N. N. W., but not the least abatement—no observation; barometer as yesterday. At 1 P. M. of 20th, wind at N. W. At 6 more violent, if possible. At 8 inclined to moderate, and the barometer to rise. At midnight still dark and gloomy—mercury rising fast. At 10 A. M. of 21st, a fine steady breeze from the westward. At noon, lat. 34° 38′, lon. 74° 20′, having made, since last observation, against wind and sea, 95 miles of northing, and 49 of longitude; barometer at fair.

Narrative of Mr. Macqueen, master of the ship Racolins, from Jamaica to London.

Latitude—Commencement	N.	30° 30′.
Termination		30 40.
Longitude—Commencement	W.	77 40.
Termination		77 18.

Wind commenced on the 16th, at N. E. by E., blowing strong from that quarter about 12 hours, then suddenly veered to N., continuing with unabated vigour till midnight of the 17th; in an instant a perfect calm ensued for one hour, then, quick as thought, the hurricane sprung up with tremendous force from the *southwest, not again shifting from that point.* No swell whatever preceded the convulsion. The barometer gave every notice of the coming gale for many hours previous. Two days antecedent, the weather was beautifully serene, but oppressively hot, with light shifting airs; the barometer at that time standing at "set fair;" during the gale so low as almost to be invisible in the tube above the frame work of the instrument. The force subsided at midnight, Aug. 18th, the sea tremendous, and rising in every direction; from the force of the wind no tops to the waves, being dispersed in one sheet of white foam; the decks tenanted by many sea birds in an exhausted state, seeking shelter in the vessel; impossible to discern any thing, even during the day, at fifty yards distance; the wind, representing numberless voices, elevated to the shrillest tone of screaming; but few flashes of lightning, and those in the S. W. On the 19th, wind and sea much abated. A dismal appearance to the N. W.

Narrative of Mr. Turner, master of the ship West Indian, from Jamaica to London.

At noon of the 14th, lat. 28° 28′, lon. 79° 45′, barometer 30.1 inches. At 5 P. M. the weather put on an unsettled appearance, and a strong swell began to set in from the E.N.E., which continued to increase, as did also the wind from the N.E.; the next morning the sky was more settled.

At noon of the 15th, barometer 30.00, lat. 31° 45′, lon. 77° 59′. The heat of the water 8 or 10 degrees warmer than the air, which became equal about midnight. Fresh winds, variable from E.N.E. to N.E., gradually increasing on the morning of the 16th. At noon, no observation, lat., by account, 31° 32′, lon. 77° 13′; barometer 30.00, blowing fresh, wind E.N.E.

At daylight on the 16th, the sky had put on a very threatening aspect; ship's head to the E.S.E., with a tremendous sea from that direction; wind and sea continued to increase all day, with rain; barometer not falling, till 5 P. M., when it went down suddenly 6‴ in. At 3 o'clock, A. M. of 17th, the hurricane commenced, and about noon at its meridian, wind E.N.E. Ship lying to; lat., by account, 31° 8′, lon. 77° 56′, barometer 29° 1′. The wind drawing more easterly. At 6 P. M., wind *east-south-east*, and inclining to the southward; just after midnight it fell nearly calm. At 2 A. M. of 18th, came out in an instant, with all its former violence, from the S. W.

At noon, by account, lat. 31° 21′, lon. 78° 6′, barometer 28° 8′; hurricane still continuing with all its former violence; at midnight it moderated a little, wind veering to the westward all the time. At 4 A. M. of 19th, the wind about W.; got the ship before the wind under close reefed topsails, and scudded before the gale. At noon of 19th, lat., by account, 31° 42′, lon. 77° 14′, barometer 29.30; continued to run before the gale all these 24 hours, the wind getting round to N. W.

At noon on the 20th, lat., by observation, 33° 32′, lon. 72° 13′. In four days ship has been set N. 52° E. 130 miles. For some days after this we had very unsettled weather, with a great deal of sea.

Log of Brig Mary.—On 16th, in lat. 31° 3′, lon. 77° 50′, thermometer, in shade, 82, water 82°, barometer 29.10, having fallen, from the 15th, six tenths of an inch. Wind E.S.E. At noon of 17th, wind E. by N., and N.E. by E. Strong gales and heavy squalls, with a head sea from N.E., barometer 29.00. Thermometer 82°.

On 18th, wind E.S.E.; increasing gales; every appearance of bad weather; bar. falling fast; labouring and straining; bar. 28° 70′. Ther. 80°. Water 82°.

On 19th, wind S.E., gale increasing to a perfect hurricane; barometer 28° 60′. On 20th, wind E.S.E., rising and falling very fast, and unsettled for the last 24 hours; barometer 28° 50′; thermometer, in shade, 74°; water 78°. On 21st, wind from S.E. to N.W.; barometer 28° 10′; a terrific appearance; thermometer, in air, 70°; water 76°; under bare poles; nothing can withstand the wind at present; hurricane continuing to rage more and more; at noon gale abating; barometer rising gradually; I could not leave the deck to note it, but it certainly must have been lower; noon 28° 40′; therm. 70; water 76. P. M., lat. 36° 12′, lon. 72° 11′. On 22d, wind S. W. to N.W.; made all sail that circumstances would permit; heavy rain, thunder and lightning; lat. 36° 22′, lon. 70° 6′; barom. 28.80.

Extract from the Log of the Barque Penelope, J. H. Grimes, Master, from Jamaica to London.—Aug. 18th, P. M. Strong gales E.S.E. and cloudy; at 4 P. M., ship labouring very much, and making a great deal of water; midnight, strong gales; at 3 A. M. of 19th, wore ship to southward, wind E. S. E. At 6 A. M. wore ship to northward; at 10 A. M. hard gales. At noon, lat., by account, 34° 56′, lon. 75° 2′, hard gales N.E. and heavy sea; at 4 P. M. gale increasing; at 8 P. M. tremendous gales. At 2 A. M. of 20th, set main trysail, to keep ship to; in five minutes it blew away in tatters; wind from E. to S.E. At 8 A. M. wind moderated; at 10 more moderate; set close reefed foretopsail; wind E.S.E. to E.; noon, dark cloudy weather; wore ship to southward; noon, lat., by account, 35° 20′, lon. 75° 20′.

In P. M. of 20th, strong gales E S.E. At 4 P. M. wore ship to N. E.

At 9 A. M., (P. M.?) gale increasing, and the wind having veered to N.N.W., came to a resolution of running before it, till the gale abated; at midnight it blew a perfect hurricane from N.N.W.; at 10 A. M. more moderate. At noon, lat. 34° 30′, lon. 72° 20′; at 6 P. M. of 21st, wind hauled to S.W. Made up my mind to gain a port to the northward of Cape Hatteras; latter part of the hurricane from N.N.W.

Extract from the Log of the Barque West Indian, Simpson, Master, from Jamaica to London.—Aug. 20, at noon, lat. 37°, lon. 64°, barometer falling, wind variable these twenty-four hours, from S.W. to E. On 21st, wind variable from S. to S.E., increasing gales and heavy sea from N.E.; at noon hard gales and hazy, barometer down below rain; lat., by account, 38° 23′, lon. 62° 40′. At 6 P. M. hard gales, wind S. At 10 blowing quite a hurricane; we are now involved in a white smoke or fog, and the water as white as a sheet. At midnight nearly calm. At 1 A. M. the wind came away from about W., and if possible blew harder than ever. At 6 A. M. it is blowing a hurricane, and continued till 2 P. M., when it moderated. Lat., by account, 39° 9′, lon. 61° 34′. I have always met with more hurricanes and tempestuous weather in the Gulf Stream than I have found either to the northward or southward, and I cannot account for it.

Extract from the Log of the Ship Ida, Tilley, Master.—Tuesday, Aug. 15. Light breezes E.N.E., and cloudy weather; at noon light breezes and fine; lat. 27° 31′, lon. 79° 36′, ther. 85, barom. 30.10. At midnight wind E.N.E. At noon on 16th, fresh breezes and squally weather; lat. 29° 54′, lon. 79° 39′; ther. 80°; barom. 29.80. P. M. strong breezes; at 3 wind N.N.E. At midnight strong breezes and cloudy, with a swell from the eastward; barom. 29.20. On 17th, fresh gales, increasing till noon, when it blew a hurricane; barom. 29, wind N.E. At midnight blowing a tremendous hurricane, with rain and heavy mountainous sea; barom. 28.50. On 18th, A. M. blowing a most tremendous hurricane, wind veering from N.E. to S.W. within the last twelve hours. At midnight of 18th, found we had run out of the hurricane, but it still blew a heavy gale. On A. M. of 19th, wind W. with strong gales and high sea. On 19th wind W. all day, and also on the 20th. On 21st S.W. all day, with strong breezes and squally; lat. 32° 7′, lon. 7° 30′, (76° 30′?) On 22d, wind S.W., light breezes and fine weather; at 4 A. M. strong breezes, and squally weather; made a signal of distress to the Citizen, and abandoned the Ida in lat. 33° 14′, lon. 75° 19′.

Extract from the Log of the Ship Westbrook, J. Freeman, Commander, from Jamaica to London.—At 1 P. M. on 15th, light baffling winds: at 7 P. M. increasing wind and looking squally; midnight, wind E.S.E., steady and clear; noon, lat. 32° 20′, lon. 76° 43′; wind variable. At 1 P. M. of 16th, wind N.E.; fresh; clear; at 8 P. M. very heavy appearance in the S, with a good deal of lightning; at 7 A. M. of the 17th, strong gales and a very heavy sea; noon, strong gales and very heavy squalls with rain; lat. 32° 47′, lon. 76° 14′. At 1 P. M. wind E. by N., strong gales and hard squalls; midnight do.; noon of 18th, blowing strong, and no appearance of change; wind E. from 5 A. M. At 1 P. M. wind S. E.; strong gales and a heavy sea. At midnight came on to blow a complete hurricane; noon, no appearance of change. Wind at S.E. until 11 A. M. of 20th, when it veered to N.N.W. Throughout this 24 hours, a terrific hurricane and heavy rain. At 4 A. M. of 21st more moderate, and at noon, lat. 34° 58′, lon. 73° 32′; wind W.N.W.

Extract from Capt. Herbert's Journal of the French Brig Volof, from Havana to Havre.—Winds variable and weak from the 12th till the 16th, when we were in lat. 32° 14′, lon. 76° 25′ west of Greenwich. Then the wind began to blow from the E.N.E., increasing in force till the 17th, when it became a most frightful tempest, continuing, without intermission till the 18th. On the 18th, from 8 A. M. till noon, great wind and rain. At 8 P. M. calm. Set two sails; but they were hardly set when the wind burst from the W.N.W. like a clap of thunder, and continued frightful all night and next day. On 20th, at 10 A. M., began to clear, and on 21st fine weather, with slight breeze from S.W; On 20th, in lat. 32° 0′.

Narrative of Mr. Griffith, Master of the Ship the Duke of Manchester. At noon on the 15th, light airs and close, oppressive weather. From 4 till midnight, wind variable from N.E. to S. by E. On 16th A. M., light variable winds, and a cloudy, confused sky.

At 8 A. M. a fresh breeze from the N., and hazy weather; a swell from the eastward. Noon, increasing breeze and cloudy; lat. 32° 39′, lon. 77° 30′. P. M., increasing breeze, wind veering from N.E. by E. to E. by N. At 5 fresh gale; at midnight fresh gales and hazy; 17th commences with strong gales and squally, with rain. Day-break, heavy gales and tremendous sea. Noon, blowing a violent gale, with dangerous cross sea; lat. 31° 59′, lon. 77° 2′.

At 1 P. M. blowing a hurricane. A most extraordinary phenomenon

presented itself to *windward*, almost in an instant, resembling a solid, black, perpendicular wall, about 15° or 20° above the horizon, and disappeared almost in a moment; then in the same time made its reappearance, and in five seconds was broken, and spread as far as the eye could see; from this time to midnight blowing a most violent hurricane; much thunder and lightning, the thunder hardly heard, although we were struck with the electric fluid; wind continued E. to E.N.E. till noon of the 18th, with equal violence. In the afternoon it changed to S.W., a little more moderate, but continued violent with heavy gales till midnight of the 20th, wind W. a few hours in the afternoon of 19th, and then S.W. from 6 P. M., and on the 20th W S.W. all day, and also 21st. On the 19th, lat. 33° 7′, lon. 75° 37′; on the 20th, lat. 33° 47′, lon. 74° 52.

Extract from the Log of the Ship Castries, from St. Lucia to Liverpool, M. Mondel, Commander.—At noon, 24th, lat. 34° 56′, lon. 57° 45′, strong winds E. by S. and cloudy. At 3 P. M. increasing gales. At 6, E. by N., blowing a hard gale with heavy rain. At 10, N. E., and at 11, blowing a hurricane. At 12 N.N.E., and at 2 in the morning of the 25th, wind N., at 4 W.N.W., and at 6 N.W., and so it continued till the 26th, clearing at 10 A. M., with strong breezes. At noon of the 25th, lat. 35° 37′, lon. 57° 42′.

Note.—We had a sudden lull at 4 P. M. of the 24th, whilst reefing topsails.

The Victoria was upset and dismasted on the 24th of August, in lat. 33° lon. 58°.

The barque Clydesdale on the 24th August, encountered a very severe hurricane in lat. 32° 30′, lon. 59° 30′. On the 23d, about noon, came on to blow fresh breezes from E.S.E. At midnight, atmosphere dark and wind S.E. At noon of 24th, blew a complete hurricane, and at midnight gale moderated.

To these logs, which are extracted from Col. Reid, I am enabled to add a few particulars from the newspapers.

From the United States Gazette of 28th Aug., 1837.—Brig Cicero, on 18th, in lat. 32° 20′, lon. 76° 40′, was struck with a hurricane from the N. E. shifting to N.W. and round to S.W. in 24 hours, and was hove on her beam ends.

Same paper of 29th. Severe gales at Washington, N. C., commencing on 18th, and continuing till Sunday evening, 20th. Five or six vessels driven on shore and wrecked.

Same paper of 30th. Delaware on 17th, lat. 31° 30′, lon. 76° 20′, had a severe gale E.S.E., and then W., which continued till 20th.

Same paper of 31st. On the 19th and 20th, barque Penelope, in lat. 33° and 34°, lon. 72°, experienced a severe hurricane.

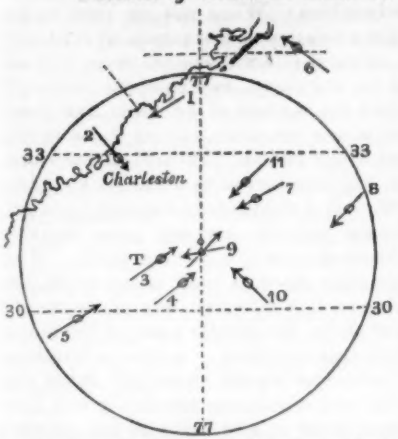
From the National Gazette of 22d. At the Delaware Breakwater on the 20th, the wind N.E. at 7½ P. M., blowing heavy with rain. At 10 A. M. of 21st, wind hauled to N.W.

From Commercial Herald of 28th. The barque King Philip, on 18th, in lat. 31° 12′, lon. 78° 16′; had a gale from N.N.E. to W.N.W.

Same paper of 29th. Brig Oglethorpe, on the 18th of Aug., lat. 32° 29′ lon. 78° 55′, had a violent gale from N.W.

Great rains occurred in the western parts of Pennsylvania, on the 15th, and on the morning of the 16th in the eastern parts. At Alexandria, D. C. wind S. on 18th.

Position of Storm at Noon on the 18th of August, 1837.



Explanation of Engraving.

1. Wind at Wilmington, on P. M. of 18th.
2. Oglethorpe on 18th.
3. West Indian, all 18th, from 2 A. M.
4. Rawlins all 18th, from 2 A. M.
5. Ida, all day of 18th.
6. Penelope on P. M. of 18th.
7. Yolof till 8 P. M. of 18th.
8. Westchester on 18th.
9. Duke of Manchester till P. M. 18th.
10. Delaware on 17th, and probably on 18th, changing round to westward on 20th.
11. Cicero on 18th.

I have culled out of this storm that portion of time in which I find the greatest number of simultaneous observations, and I have exhibited on the annexed wood cut the localities of all the ships within the boundaries of the storm, whose latitudes and longitudes could be ascertained with any degree of certainty, with arrows, exhibiting the course of the wind. The time is noon of the 18th of August, 1837. At this time the Duke of Manchester was only a few miles N.E. of the centre of this storm, for some time in the afternoon the centre of the storm passed nearly over her, when the wind changed pretty suddenly S. W. At this time, and for some seven or eight hours both before and after, all those ships which were labouring in the most violent part of the storm, had the wind blowing towards a central space of no great magnitude. This settles the question of a violent centripetal motion of the wind in this storm, in conformity with the five previously examined, and also with the twelve investigated by the Joint Committee of the American Philosophical Society and Franklin Institute, and with not less than fourteen land spouts which have already been examined, in all of which the trees were thrown with their tops inwards—and when any are thrown across each other, those which are underneath are uniformly found to be thrown inwards and backwards, and those on the top to be thrown inwards and forwards, just as they should be, if the wind blows inwards. Whereas, if the wind is centrifugal, many of the trees should have the tops thrown outwards on both sides of the path. Let the reader cast his eye on the chart, and he will perceive, in the borders of the storm, some anomalies worth his particular attention. If I have really discovered a true law of nature in these storms, these apparent anomalies will be found to confirm the law in a wonderful manner. Just as the moon's anomalies, when understood, were found to harmonize, in a most beautiful manner, with the law of gravitation. The anomalous arrows in this storm are the Penelope and Wilmington on the N., which seem to favour the idea of a rotation of the air from right to left, and the Westchester on the east, which seems to indicate a rotation from left to right. This is in conformity with phenomena accompanying storms previously investigated by the Committee, (see second Report, and also September No. of the Journal of the Franklin Institute,) and it is in exact conformity with what ought to take

place, if the wind does blow inwards towards the centre of the storm; as will appear from the following considerations. When the air rises in the centre of the storm, and expands by the evolution of the caloric of elasticity given out in the formation of cloud, upwards of six thousand cubic feet for every cubic foot of water generated in the cloud, as explained before, it must spread out in an annulus all round the borders of the storm, and cause the barometer to rise, in that annulus, above the mean, just as it did in this storm to the Rawlins, the Sophia, and West Indian, (Turner) as the storm was approaching their vessels, and as it is now known to do in all our great N.E. storms that come from the S.W. If a storm should spring up in our neighbourhood, that is, commence in our vicinity, and not come upon us from a distance, such a rise of the barometer could not take place. Now this rise above the mean will evidently take place in front of the storm, because the upper current of air is moving in that direction, and of course the great body of the upmoving column of air in the middle parts of the storm will be pressed by the upper current in that direction. And it is manifest, that beyond the annulus where the barometer stands above the mean, the air will blow outwards from the storm, and within the annulus it will blow inwards. But as in front of the storm there is one point of the annulus where the barometer stands higher than in any other, the wind will tend in all directions from that point, and of course it will cause the wind, in the very borders of the storm, to appear to rotate both ways.

As the air must necessarily come downwards in the annulus where the barometer stands above the mean, "set fair," for instance, as it did with the Rawlins, we would expect the weather to be without a cloud, and very hot, as it was. Indeed it would be easy to show, that if the air in the annulus were to come down from a height of four miles, it would be about 45° hotter than it was when it left the surface of the sea in the centre of the storm to go up, for it would bring down with it the caloric of elasticity evolved, as it went up, by the condensing vapour, and the quantity evolved in going up a given height is known if the dew-point is given. But the full explanation of this subject is reserved for another occasion.

The centre of the storm at the moment I have chosen, the noon of the 18th, was between 31° and 32° N. lat., and was at that time moving about N.E., for the centre passed over the Rawlins, and very near to the Yolof, about 150 miles to the N.E. of the Rawlins. In this part of its course, it traveled only about 8 miles an hour; for it passed over the Rawlins at half after 12 in the morning of the 18th, and did not reach the Yolof till 8 P. M. of the same day.

If this storm was round on the 18th, of which we have no proof to the contrary, there is strong reason to believe it did not long continue round. For on the 21st, it reached from the Westbrook to the West Indian, (Simpson) about 700 miles; so that unless it widened out in like proportion in the other direction, its N.E. and S.W. diameter became greater than that from N.W. to S.E. If this was really the case, as it was in the storm of 1821, and if it moved towards the east, then all the phenomena would be easily explained, and the storm of the Wanstead and the storm of the Clydesdale, Victoria, and Castries would be one and the same storm.

This can be ascertained hereafter; for in this case it is probable that Bermuda experienced something of it on the 22d and 23d. If this meets the eye of any person acquainted with the fact, either one way or the other, let him communicate it to the world. New facts connected with any of the storms here investigated would possess a very high degree of interest.

It appears from the logs of the Clydesdale and the Castries, that the storm passed over them about the same time, though the latter ship was near 200 miles to the N.E. of the former. Now this can only be accounted for on supposition that the centre of the storm is not a *point*, but a *line*, lying in the direction of N.E. and S.W., and moving side foremost, or obliquely. There is another circumstance which favours this idea, namely, the storm lasted a much shorter time with all the vessels on the 21st, 22d, 23d, and 24th, than on the 18th, though the storm was much greater in diameter on these days from N.E. to S.W. than it had been before, even with those ships near which the centre passed,—for instance, the Columbus and the Delos. But it is useless to conjecture. The data are not yet sufficient to demonstrate whether there were two storms or one. I will merely add, that if the line joining the Clydesdale and the Castries should be prolonged, it would pass a little E. of the place where the Wanstead experienced a severe gale on the day before, lat. 43° 34′, lon. 54° 20′, which also favours the idea that these two storms were one and the same, with a long diameter from N.E. to S.W.

Raleigh's Typhoon of the 5th and 6th of August, 1835, in the China Sea.—As Mr. Redfield, of New York, has given a more full account of this storm than Col. Reid, I extract the following details from him.

"*H. M. Brig Raleigh*, Aug. 1, 1835.—Working out of Macao Roads.—At noon, east end of Grand Ladrone, E. ½ S.—Aug. 2d, at noon, S.E. end of Formosa N. 85 E. 340 miles: fine weather all day.—Aug. 3d, at noon, S. end of Formosa N. 82½ E. 252 miles. Fine weather all day.—Aug. 4th, 10h. 20m. A. M. close reefed topsails and courses:—12h. 30m. P. M.—barometer fell from noon $\frac{15}{100}$; took in mainsail and foresail;—at 1h. 30m. got all snug; vessel going through the water between 3 and 4 knots; barometer 29.40, falling;—at 7h.30m. wind veered to N.N.E. and typhoon commenced; at 8 P. M. barometer 29.36, falling;—8h. 30m. typhoon increasing;—10 P. M., close reefed fore trysail and set it;—typhoon veering to E.N.E. with a heavy sea;—at midnight typhoon increasing; barom. 29.04, falling.

"Aug. 5th.—3 A.M. typhoon veering round to E.S.E., still increasing in violence;—6h. 30m, barom. 28.25;—8 A.M. typhoon increasing;—9h. 30m. A.M., if possible blowing heavier, *ship went over;*—in this awful situation the ship lay for about 20 minutes;—9h. 50m. lower masts went by the board and ship righted with 7 feet water in her hold; barometer did not fall lower;—at noon typhoon moderated a little;—at 6 P.M. typhoon more moderate, with a heavy sea;—midnight, strong gusts of wind with heavy sea from S."

Abridged from Canton Register of March 14, 1837.

At *Macao*, where the typhoon was experienced on the 5th and 6th, many houses were damaged; also many lives were lost in the inner harbour, and some vessels were driven on shore. The direction and changes of the wind at Macao are not stated; but we are favoured with the following valuable table of the state of the barometer during the period of the storm.

"August 5th:

h. m.		Barom.
1 00	a. m.	29.47
2 30	p. m.	29.28
5 00	"	29.20
7 20	"	29.12
9 00	"	29.08
10 20	"	28.95
10 45	"	28 90
11 05	"	28.85
11 30	"	28.75
11 53	"	28.65
August 6th.		
0 15	a. m.	28.50
0 30	"	28.40

h. m.		Barom.
0 45	a. m.	28.30
1 20	" (*lowest*)	28.05
1 25	"	28.08
1 45	"	28.20
1 55	"	28.30
2 00	"	28.37
2 25	"	28.56
2 45	"	28.68
3 10	"	28.75
3 40	"	28.83
4 10	"	28 90
4 45	"	28.97
5 15	"	29.02
6 00	"	29.08

h. m.		Barom.
6 45	a. m.	29.12
7 45	"	29.20
8 15	"	29.21
8 45	"	29 23
9 30	"	29.27
10 25	"	29.30
11 00	"	29.34
2 00	p. m.	29.42

and continued rising to 29.65, at which point it usually stands during fine weather." — *Canton Register, Aug.* 15.

This table affords, in itself, good evidence of the passage of the centre of the vortex near to Macao.

At *Canton*, (60 miles N. of Macao,) the typhoon began on the evening of the 5th, after three or four days of very hot weather, with northerly winds, and continued throughout the night and the next day. Its violence was greatest about two o'clock on the morning of the 6th. The following is an account of the state of the barometer and winds at Canton:

August 4th.

9 a. m.	barom.	29.79	Wind N.W.	Fine weather.
4 p. m.	"	29.70	" N. by W.	Moderate breeze.

August 5th.

9 a. m.	"	29.62	Wind N. and N.W.	Fair weather.
4 p. m.	"	29.54	"	unsettled—Rain and fresh breeze.
12 p. m.	"	29.37	"	N. blowing hard and in heavy gusts.

August 6th.

5 a. m.	"	29.34	Wind N.E.	blowing hard with heavy rain.
9 a. m.	"	29.51	" S.E.	do. do.
11 a. m.	"	29.58	" S E.	blowing hard—moderating.
5 p. m.	"	29.70	" S.E.	do.
11 p. m.	"	29.85	" S.E.	do.

August 7th.

8 a. m.	"	29.94	Wind S.E.	Cloudy.

Compiled from the Canton Register.

On Wednesday, the 5th inst. a tyfoon swept over the city of Canton. It began in the evening and continued throughout the night and the next day, blowing its best about 2 o'clock in the morning. The damage done by the typhoon at Canton is small, but not so at Kumsingmoon, Macao, and elsewhere on the coast.—*Canton Paper.*

Extract from a private letter from on board the ship Lady Hayes, which left Macao Roads a day or two before the storm, and returned to Kumsingmoon, after the gale.

"Early on the morning of the 5th, we observed indications of bad weather. At 10 A. M. the wind freshened a little from the same quarter it had been for the last 24 hours, viz. *north;* so we thought it best to turn her head back again to look for shelter, fancying ourselves to be about 35 miles off

the land. We carried a press of sail until noon, when we found we had too great a distance to run before we could get into shelter, and expecting it would get so thick that we could not see our way; so we turned her head to sea, and clapped on as much sail as she could stagger under, *steering S. E. by E.* The wind being then at N., we were desirous of getting as far off the land as possible, expecting the wind round to the eastward, there being a most *tremendous swell* from that quarter. *At* 4 *P. M.* it was blowing in severe gusts, and we shipping a good deal of water, and the ship becoming unmanageable. About 8h. 30m. *the wind began to veer to the west,* but continued to blow as hard as ever, till midnight, when it *drew round to south,* and moderated a little. It continued to blow hard from that quarter until noon of the 6th, when it moderated fast, and we began bending other sails in room of those that were split. When the gale commenced, which we consider it did *at* 1 *P. M. on the 5th,* we were about 20 miles E. of the Lema; where we were when it ended it is hard to say, as we saw nothing till the morning of the 7th, when we made Mondego Island. We hardly think we could have had the gale so heavy as those inside; and what is most extraordinary, the wind with them *veered to the eastward round to south;* but with us it veered to the *westward* round to south. It was fortunate for us that it veered to the westward; for had it veered to eastward, we should most likely have been driven on shore among the islands, as we could not have been more than 50 miles off the land, at 8 P. M. on the 6th.—*Abridged from the Canton Register of August* 18*th.*

Log of the American Ship Levant, Capt. Dumaresq.

Courses.	Winds.	August 4th, 1835. [Nautical time.] Throughout these 24 hours fine breezes and clear, pleasant weather. All possible sail set. Current N.E. by N. 50 miles. Lat. by obs. 12° 55′ N. Lon. by chr. 112° 13′ E.
N. N. E. Distance by log, 171 miles.	S. W. Breeze $6\frac{1}{4}$ to 8 knots.	
N. b. E. $\frac{1}{2}$ E. N. b. E. Distance by log, 190 miles.	S. W. Breeze 7 to $8\frac{1}{2}$ knots.	Aug. 5th. Commences with fine breezes, and pleasant. All sail set and trimmed to the best possible advantage. Middle and latter part the same. Lat. by indifferent obs. 15° 55′ N. Lon. " " 113° 24′ E.
N. $\frac{1}{4}$ W. Distance. by log, 225 miles.	S. S. W. Breeze $8\frac{1}{4}$ to 10 knots.	Aug. 6th. Begins with fresh breezes, and cloudy. All sail set. At 4 P. M. passed a barque standing eastward. Through the night strong breezes and squally, with rain and heavy sea. Latter part the same. Took in the royal studding sails. [The ship was now running into the path of the gale which had just passed.] At 11 A. M. [6th] heavy squalls, with rain in torrents. Took in all studding sails, royals, and top-gallant-sails, and double reefed the topsails. No observation: sun obscured. Lat. by account 19° 54′ N. Lon. " 113° 38′ W.

Courses.	Wind.	
N. ¼ W. North. N. ¼ W. North. N. b. E. to N. W. and to N. E.	South to S. S. E. s. b. w. to s. E.	August 7th. From noon to 8 P. M., strong breezes and squally. Shook out reefs and set all light sails. Middle part, fine breezes and pleasant weather. At daylight made the Ass's Ears bearing E. by N., distant five miles, At 7 passed the Great Ladrone. After part, wind S. E. and pleasant.

Now, if the reader will take a map of the China Sea, and choose any particular moment, from 4 P. of the 4th till midnight of the 5th, and draw arrows representing the course of the wind through Canton and the respective localities of the Raleigh and the Levant, he will find they will nearly meet, if prolonged in a central space of no great magnitude, where the storm must have been at that time, if it traveled regularly from the time of passing the Raleigh, at 3 A. M. of the 5th, till it passed Macao, a little after midnight on the morning of the 6th, and at the moment when the barometer stood lowest at Macao, the wind was N. at Canton, and S. with the Levant, both blowing exactly towards Macao.

Again, it is worthy of remark, that the wind had been N. for several days at Canton, and immediately on the setting in of the typhoon, the wind became occasionally N.W., whereas, on the whirlwind theory, it ought to have turned more N.E. The same may be said of the wind with the Levant; on the passage of the typhoon, the wind changed round to S.E. as the storm passed away to the N.W. When the storm passed Canton, the wind changed round to the S.E., and continued blowing exactly towards the centre all the 6th, that is, on supposition this storm moved in the same direction as the West India storms in this latitude, as it is known they curve rapidly on reaching this latitude towards the N.W. and N. As to the Lady Hayes, it is impossible to tell where she was, as her log leaves that undecided; but if she was near Macao at about 3 P.M. of the 5th, then from that to midnight, an arrow drawn in her locality would, for that time and for some time afterwards, point inwards towards the same space with the other arrows.

Mr. Redfield says, in the pamphlet before me, that "he considers the depression of the barometer in these tempests, as due to the rotative action, and the point of greatest depression, as indicating the true centre or axis of storm."

But this cannot be the case, for I have shown in one of my essays in the Journal of the Franklin Institute for 1836, that it would require an outward motion of the air from the centre of 240 ft. per second to make the barometer fall an inch, and of course a corresponding motion downwards in the centre of the storm. And Mr. Redfield says he "has but little objection to my formula on this point, subject to such corrections for countervailing tendencies as the case requires." See Journ. Frank. Inst. for Feb. 1837. Now, as the wind tended inwards in this storm, the cause here alleged for the fall of the barometer is not the true one.

But Mr. Redfield has proposed a means of testing my theory in the following paragraph:

"*Test of Mr. Espy's Theory.*—The truth or error of Mr. Espy's theory may be ascertained by a very simple test. The hurricanes in the West Indies are known to move towards the W N W. nearly. Now, if this

theory be true, at these islands which are in the centre of the storm's path, and where the gale is of the greatest duration, the wind will set in at about W.N.W., or exactly opposite to the course of the storm, and when its centre has passed over, will shift suddenly to E.S.E., and continue violent in this quarter till the storm is over. But if the gale be a whirlwind, as the facts seem to show, the wind at such places will set in at about N.N.E., and in the middle of the gale will shift nearly to S.S.W.—the wind varying from these points, and veering more gradually on either side, in proportion to the distance from the centre of the storm's track. That this corresponds, mainly, to the facts of the case, will hardly be doubted by those who institute the inquiry. The same test may also be applied to these storms, as they move in a N.E. direction along the shores of the United States; where, according to Mr. Espy's views, the gale, on the centre of its path, should blow, for the first part of its duration, from about N. E.; and in the second half from nearly S.W. But all our inquiries serve to show that the gale is violent at N.E. only on the northern portion of the track of the tempest, and that the usual changes from this direction are not sudden, and to an opposite point of the compass; but instead thereof, we observe a gradual veering by the N. to the N.W."

I accept this test with the corrections which I am sure Mr. Redfield will allow, namely, on Mr. Redfield's theory if the wind sets in N.E., in storms on our coast, it never can change round to N.W., not even gradually, as he acknowledges it does. Second, this test can only apply to round storms, and if any shall be found with their N.E. and S.W. diameter much longer than their N.W. and S.E., then if such a storm moves towards the eastern quarter, the wind, on my theory, ought to set in from S.E., and change suddenly round to N.W. as a general rule.

It being always understood that allowance is to be made for oblique forces produced by various causes, but especially by an annulus or semi-annulus of increased barometric pressure to the N. or N.E. of the storm in its onward motion. Let us then put the theory to the torture.

Numerous examples were given in the storm of 1821, before investigated, all harmonizing with the test here proposed by Mr. Redfield, to which the reader is referred in the last No. of this Journal. Nor is the present storm of 1837 wanting in remarkable examples. The Ida changed round from N. E. to S.W. in twelve hours, having begun at N.N.E. and continued to blow, all day of the 18th, S.W., exactly towards the Rawlins and the Yolof, during which time the centre of the storm passed near both those ships. The Rawlins, also, which remained nearly stationary during the storm, as appears by her log, had the wind to set in N.E. by E., and changing round to N., after a calm of one hour, sprung up quick as thought from the *southwest*, and it did not change again from that point. The Duke of Manchester also had the wind to change round from N.E. by E. through the E. to S. W., from which point it blew with violence till the afternoon of 19th.

The Yolof is a slight exception, but the phenomena with her will not agree so nearly with the centrifugal theory as it will with mine. The wind changed round with her from the E.N.E. to W.N W.; how long it continued there is not mentioned. The direction of the wind is not mentioned from 8 P. M. of 18th, when it changed, till the 21st, when it was only a slight breeze from S.W. These are the only vessels having the centre of the storm passing near them. Let the candid reader judge how they satisfy the conditions required by the "test."

I will now give all the evidence on this point which I have at my com-

mand, of hurricanes, both in the West Indies and in the Bay of Bengal. It was mentioned before, that Edwards, in his History of Jamaica, vol. 3d, says that "all hurricanes begin from the N., veer back to the W.N.W., W., and S.S.W., and when got round to S.E., the foul weather breaks up." And he also says, in the same volume, "when the wind is S. and S.W. on the S. side of the island, it is often north-easterly on the N. side, attended with heavy rains." As Mr. Edwards lived on the S. side of the island, it may well be asked if the winds on the N. side of the island in time of hurricanes do not change round from N. by E. with as much constancy as he says they do on his side round by W.? Also, Col. Copper, speaking of the great hurricane which occurred on the Coromandel coast, on the 29th Oct., 1768, page 60, says: "the wind began from the N.W., *as is usual at the commencement of these hurricanes.*" And Col. Reid says this same hurricane terminated S.E. (page 264.) And on next page he says, of another quoting from Col. Copper, that it began in the N.W., and suddenly shifted to the eastward.

In the great Barbadoes hurricane, of 1831, August the 10th and 11th, as given by the author of the West Indian, the wind began N., varying from N.N.E. to N.N.W., during the first half of the storm, but strongest from the N.W. and N.N.W., and terminated from the S.E., though once it reached round for a few minutes near the end of the gale to E., and soon got back to S.E., increasing to a hurricane, but unaccompanied with those fatal gusts which, from the western quarter, had effected so much destruction—the hurricane terminated two hours and a quarter after this, with strong breezes from the E.S.E., and an hour after that, the dense body of cloud began to break up. (p. 38.)

Luke Howard, in his second vol., gives an account of a hurricane at St. Lucia on the 21st Oct. 1818. "The wind is stated to have set in N.W. at daybreak, and raged with tremendous violence, with occasional falls of rain, until 3 P. M.; when becoming southerly, it abated, but did not immediately cease."

It would appear, from the following account, that in latitudes as high as 25°, the storm sets in N.E. and terminates S.W. Mr. Howard, in his 1st volume, speaking of the Nassau hurricane of the 26th July, 1813, says, "At about half past 2 P. M. the hurricane attained its greatest height, and its acme continued, without interval, until five, when *it suddenly ceased, and in the space of half an hour succeeded a calm*, so perfect that it can be compared only to that of death after the most dreadful convulsions. The inhabitants of the colony, well knowing the nature of hurricanes, took every precautionary measure within their reach, during the calm, or lull, to prepare for the second part expected from the S.W., and which set in with great fury at about six o'clock, and continued until midnight, when it considerably abated, and soon after totally ceased. The first part of the storm from the N.E., raged without intermission, but the latter part appeared in heavy blasts of a few minutes' duration.

If the reader will refer back to the investigation of the great Barbadoes hurricane of 1780, he will find evidence of the most decisive character on this point. By examining all the accounts of the beginning of the storm at Barbadoes, he will discover, that though the wind began to blow from the N.E. with some violence, from the oblique force produced by the trade winds, which in this region are known to blow all the year, yet it backed round to N.W., and blew for many hours with its greatest violence, and then changed back again by the E. to the S.E., beyond which it did not go.

Now, as the centre of the storm certainly passed within a few miles of the western side of this island, as shown before, for it passed between Barbadoes and the Albemarle, which left Barbadoes during the storm, the facts furnished here are even more conclusive than if it had been merely stated that the wind commenced N.W. and terminated S.E.

It is hardly necessary to remark, that as this storm, after passing Barbadoes, traveled nearly N.W., and not W.N.W., the conditions required by the "test" are fully answered.

In concluding the examination of this storm, I earnestly recommend to gentlemen who embrace the whirlwind theory of storms, to abstain from laying down rules to the practical navigator, founded on this doctrine, until it is better established than it is at present. And especially I recommend this course to Mr. Redfield, lest the practical evils arising from unfounded rules may diminish the lustre which his great discovery of the *translation of storms in space, and their continuity in time*, is beginning to shed round his name.

Philadelphia, April 6th, 1839.

(TO BE CONTINUED.)

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1838,

With Remarks and Exemplifications by the Editor.

177. For an improvement in the *Force and Suction Pump;* Andrew Bailey, Jefferson, Ashtabula county, Ohio, May 4.

The claim under this patent is to "the construction of the valve boxes, in combination with a double pump barrel, constructed substantially as described;" which description it would be an entire waste of time and space to give at any length to the reader, as the, so-called, improvement consists in a mere change in the form of the parts, which change does not appear to us likely to render the action of the instrument better than that of pumps previously constructed; on the contrary, we think it will be found inferior to the greater number. A single cylinder is to be employed, and this is to be made to operate as two cylinders by a partition dividing it into two semi-cylinders, each to be furnished with a semi-circular piston, which is a bad form; to each of these semi-cylinders there are to be two lateral valve boxes, after passing through which the water is to be forced up vertical tubes, the pistons being worked by a double crank; an arrangement by which the direction of the water will be changed as frequently and as abruptly as could be desired by any one who wished to sacrifice power.

178. For an improvement in the mode of *Applying Springs to Clocks;* Joseph S. Ives, city of New York, May 4.

Instead of placing the main springs of spring clocks within the frame, and between the plates, in the usual manner, there is to be a box, or cap, attached to the outside of the front plate, the cavity within which is to contain the spring, that is to operate on an arbor in the usual way. The claim is to the so placing of the spring; and the patentee states that "by

this method, springs can be applied to any common clock, made to run with weights, without making any alteration in them, or taking them in pieces."

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179. For an improvement in the *Speeder for Roving Cotton;* William Mason, Taunton, Bristol county, Massachusetts, May 4.

The claims made are to "the manner of connecting the ground spindle with the pulley and with its hub, and with the flyers, so that it can be drawn out for doffing, as described; and also to the construction and employment of centrifugal levers, made and operating in the way above described." We cannot offer an adequate description of the things claimed, without the drawing; the mode of admitting of the withdrawing of the spindle for doffing is ingenious, and manifestly good. The centrifugal levers are small pieces of metal attached by joint pins to a flanch on the end of a hoop which constitutes a part of the open end of the flyer, or cap. These levers are curved, and are heaviest at their outer ends; the thread passes through a hole in their inner, or smaller, ends, as it proceeds from the tube which carries it through the flyers. By their weight, at their outer ends, these levers expand by the centrifugal force, with a power proportioned to their velocity, causing their inner ends to press upon the spools, and laying the yarn hard and compact upon them; and, consequently, admitting of a very high degree of speed.

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180. For an improvement in *Carriage Springs;* Elbridge G. Woodside, Augusta, Maine, May 4.

These springs are to be scroll, or volute, springs, like those used for clocks, but made sufficiently strong for the purpose intended. They are to be attached in any convenient way, so that they may act as carriage springs. The patentee says: "Although such scroll or volute springs are well known, and have been long used for various purposes, they have not heretofore been used in the manner described, for the purpose to which I have applied them, namely, that of carriage springs; I therefore claim as my invention, and ask an exclusive right to, the adaptation and application of such springs to carriages, substantially in the manner set forth."

It is believed that such springs have been applied as carriage springs, long since, but the evidence of this fact must have been before the office to justify it in the refusal of a patent. This, it is believed, was the principle upon which the grant was made; it being the practice of the office to give all the benefit of a doubt to the applicant, leaving him finally to sustain his claim, if he has a valid one, in a court of law.

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181. For an improved method of *Packing and Storing Ice;* Frederick Tudor, Boston, Massachusetts, May 4.

(See Specification.)

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182. For a *Machine for Manufacturing Shot;* Alfred Duval, city of Baltimore, May 8.

This machine is for casting shot, from lead; the patent is taken principally for the manner in which the respective parts are arranged for the convenient performance of the operation; the moulds are fixed around the periphery of a circular revolving table, above which is the furnace and cru-

cible for melting the lead, which passes down through a tube to the mould. The claims are as follows:

"1st. Moulding shot by means of a horizontal revolving wheel of moulds, which receive the melted lead directly from the crucible, and discharge the shot, when moulded, by dropping the under section of the moulds as they pass from the end of the way. 2d. The double handed tube and receiver for conveying the lead to the moulds, and the construction of the receiver for shearing off the superfluous lead from the top of the moulds, and conveying it over the centre partition of said receiver to the forward part of the same. 3d. The combination of the hanging frame rollers and hammers for keeping the moulds from springing upwards, and for discharging the moulds by the action of the tappet hammers upon the mould plates. 4th. The arrangement of the reservoir, tubes, and trough, for cooling the moulds, as described. 5th. The perforated elevators, and column of water passing through them for cooling the shot. 6th. The arrangement of the cylinder for polishing the shot. 7th, The construction and arrangement of the frustum of cones for compressing and rounding the shot."

The cylinder for polishing the shot is to revolve with the shot within it, accompanied by some black lead; what there is special in this arrangement we are not informed. "The frustum of cones" consists of a conical nut revolving like the old coffee mill nut, within a hollow cone, the nut having a semi-cylindrical groove around it, descending spirally, and the shot being fed into this, and passing down the semi-cylindrical spirals, are to be rounded thereby.

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183. For a machine for *Hulling Clover Seed;* Daniel Hunsicker, Hartley township, Union county, Pennsylvania, May 8.

This machine is constructed very much like some which have preceded it, and which have not answered very well in practice. The seed is to be hulled by being rubbed between a cylinder and a concave adapted to it; the improvement consisting in the manner of forming these, being to "the making the cylinder of teeth out of separate cast iron rings, and also the making the concave of separate segments, as described."

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184. For a machine for *Thrashing Clover;* Samuel Keen, Strasburg, Shenandoah county, Virginia, May 8.

This patent is taken for adapting a cylinder thrashing machine to the thrashing, or hulling, of clover; as this arrangement does not give it a character differing much from that of other clover hullers, we shall merely state the claim, which is "to the arrangement of the sheet iron concave for the purpose of adapting the machine to the purpose of hulling clover seed."

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185. For an improvement in the geared *Drill Stock;* George Page, Keene, Cheshire county, New Hampshire, (now of Baltimore) May 8.

Drill stocks, worked by a wheel and pinion, are well known, and the addition made to this instrument by the patentee consists in placing a friction roller under the large wheel, on the side opposite to the gearing, so as to sustain it near its periphery, instead of allowing it to bear on its gudgeons only. The claim is to the manner of combining the friction wheel with the working gear of the drill stock.

186. For an improvement in the *Cotton Compresser;* Henry Waterman, Bath, Lincoln county, Maine, May 10.

This *cotton compresser* appears to be a press for pressing cotton, the power being applied to it through the intermedium of a toggle joint, and the bale to be pressed is to be acted upon both above and below at the same time, the bed piece of the press being raised as the follower is depressed. The bed piece, or lower follower, is connected by rods to a cross head on the upper ends of the upper levers of the toggle joint, and the upper, or ordinary, follower, is connected to the lower ends of the lower levers of the toggle joint. When the toggle joint is bent, these followers will consequently recede from each other, and will approach when it is straightened, which straightening is to be effected by means of a shackle bar on a crank shaft, turned by a wheel and pinion. The whole pressing of a bale of cotton, or of a bundle of hay, must, under this arrangement, be effected by a single straightening of the toggle joint; and if this can be done, the said joint must have a pretty long sweep, as the unpressed cotton occupies a very large space. The claim is to "the before described mode of giving the follower a simultaneous movement upward whilst the piston moves downwards, thus pressing the substance placed between them on the bottom as well as on the top."

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187. For a machine for *Skiving or Whitening Leather*; Seth Graham, Roxbury, Massachusetts, May 10.

This machine is necessarily described at considerable length, with numerous references to the drawing. The patentee says that he is "not aware that the knives used in the operation of skiving and whitening leather have ever before been operated by machinery; the mode heretofore practised being by manual labour; my general claim, therefore, has been to the arrangement and combination of the whole of the above machinery that gives motion to the knives," &c. It would be useless to give these claims, as they would not, without the machine, or drawings of it, afford any idea of the particular construction in question. We will remark, however, that so far as a judgment can be formed from the materials before us, the machine appears to be well calculated to fulfil its intention.

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189. For a machine for *Hulling Clover Seed*; Jacob Flook, Middletown, Frederick county, Maryland, May 10.

A square box is to be furnished with three, or more, floors, on horizontal partitions covered on each of their faces with graters of perforated sheet iron. Through each of these floors there is an opening to allow the seed and hulls to pass down from one to the other, A vertical shaft passes up through the centre of the box, and is made to revolve by suitable means; this shaft carries arms which occupy the spaces between the floors, and which are, like the floors, covered with graters of sheet iron. The upper part of the box forms a hopper in which to put the clover to be hulled. The box is divided into halves by a cross section down its middle, allowing it to be separated for access to the interior. The claim is to "the combination and arrangement of the roughened floors and arms for hulling clover seed, in the manner described; also to the constructing the machine in two parts."

190. For an improvement in *Locks for Doors, Chests, &c.*; Robert Wilson, Burdett, Tompkins county, New York, May 10.

The claim made in this lock is to "the combination and arrangement of the safety spring, spring guards, and studs, or points, in the manner described." The safety spring is riveted to the plate of the lock at one of its ends, the other end springing up, and bearing against a projection on the bolt, and preventing it from being moved until the key, by its particular construction, and the manner of using it, is made to depress the said spring. The particular arrangement could not readily be described in words; but we do not think that this will be any special source of loss, as the contrivance is one of that character which may be made by any person of very moderate mechanical skill, and of a kind which a skilful workman could invent, with variations, every day of his life.

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191. For a *Churn*; Rufus Porter, Billerica, Middlesex county, Massachusetts, May 10.

The external form of this churn is that of a square box; its bottom is concave to adapt it to the dashers which are to be made to revolve within it by means of a winch. There are two openings in the lid for ventilation. The mode of fixing the winch into the dasher shaft, and also the particular manner of constructing all the parts, are described with much minuteness and clearness; but, after all, there seems but little to distinguish the apparatus from numerous other churns of the same general character. The claims are to "the mode of ventilation and the method of adjusting the crank to the dasher by a twisted tenon." It will be seen, therefore, that the patentee himself does not discover much of novelty in his apparatus.

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192. For an improved *Pencil Case;* Thomas Addison, city of New York, May 10.

In this pencil case, the pencil is to be protruded by means of a spiral groove and a pin working in it, in a manner which, as is stated in the specification, was invented and introduced several years since, but which was abandoned because there was not any adequate provision for preventing the shoving back of the pencil when in use. The object of the present improvement is to remove this defect, and the claim is to the "making a spiral channel or screw in the inner or outer tube in combination with a seat in the lower end of either to receive the stop of the pencil tube, to prevent the pencil or pen shoving back whilst writing."

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193. For an improved mode of making *Table Knives and Forks;* George Ropes, Portland, Maine, May 10.

The claim under this patent shows the nature of the whole invention, which "consists in making the blades and start of the common table knife, except the bolster, in a single piece by cutting from sheet steel, instead of making the start in a separate piece and welding it on to the steel blade, as heretofore done; and for fastening the bolster on to the table knife or table fork, in either or all of the methods described; and also for making the bolster of the table knife or fork by either of the methods described. I also claim the making the handles of table knives and forks of any suitable metal by casting them on, either in connexion with, or separate from, the bolster, as above described."

The modes referred to of "affixing to the knife, and also to the common

table fork that projection commonly called the bolster, is by casting, riveting, or soldering, it on to the start of the knife or fork after the blades and starts are made as above described," &c.

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194. For a *Mill for Grinding Grain;* Perry Davis, North Providence, Rhode Island, May 17.

This is an addition to the numerous family of portable grist mills, the improvement in which is said to consist in "the manner of hanging and adjusting the upper stone, or bed, and for raising and lowering the lower stone, or runner;" and the claims are to "the raising and lowering the spindle vertically, without producing infringements, by means of the arrangement of the rollers in the bridge tree, as described. The method of hanging the bed stones by means of sliding blocks and screws, as described. The method of hanging the runner to the spindle so as to raise and lower it by means of the bushing and screws."

It seems that the office considered that there was novelty enough in the things claimed to render it proper to grant a patent; but as we do not perceive in them any thing which is a substantial improvement in this kind of mill, it would be loss of time to particularize the peculiar devices claimed. There are inherent defects in the small portable grist mill, which of course cannot be removed; but, barring these, we believe that it has already been made as useful and convenient as the nature of the case admits.

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195. For a *Thrashing Machine;* Linus Yale, Samuel W. Stimson, and Nathaniel Stimson, Little Falls, Herkimer county, New York, May 17.

The claim under this patent consists in the "placing the spikes in a narrow circle on the face or edge of the large wheel, in combination with the hopper, as described."

A large wheel is to be driven horizontally, and is to have on its face, near its periphery, rows of spikes projecting upwards; and on a part of the frame, above these spikes, there are to be others projecting downwards. The grain is to be fed on to the wheel from a hopper. The arrangement is novel, but, until convinced by actual experiment, we shall not be prepared to believe that this machine will operate as well as many others previously used.

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196. For an improvement in the *Loom for Weaving Satinett, Kerseymere, and other Cloths;* John D. Seagrave, Uxbridge, Worcester county, Massachusetts, May 17.

"The nature of my invention consists in attaching to what is commonly called the top roller, or top harness roller, of satinett, and all other looms using more than two harnesses, an apparatus that will make a plain selvage of any width desired while the body of the cloth will be waled, or kersied. The claim is to "the combination of the separate selvage harness with the top roller, as described."

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197. For an improved process for *Gilding Copper, Brass, &c.;* Geo. Elkington, kingdom of Great Britain, May 17.

(See Specification.)

198. For an improved *Corn Eradicator;* Peregrine Williamson, city of New York, May 17.

This is an instrument for removing corns from the feet, which operates upon the well known principle that if they be not subjected to pressure in any degree they will disappear. A small plate of metal is to be made concavo-convex, for the purpose of covering the corn, the concavity being such as to receive it, without touching it. The edges of this plate are perforated, so as to admit of its being attached to a strip of cloth, by which it may be fastened round the toe, or foot. The claim is to "the forming a metallic plate so that it shall be concavo-convex; and applying the plate so formed to the eradication of corns in the manner set forth."

We have removed corns by an analogous contrivance, namely, by sewing together several thicknesses of woolen cloth, and punching a hole through the pad thus made. This is to be confined in place so that the corn shall enter the hole; the relief is immediate, and the cure certain.

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199. For an improvement in the *Plough;* Henry Taylor, Montague, Franklin county, Massachusetts, May 17.

The claim made is to "the peculiar mode of attaching the coulter and share, and extending the share up so high as to receive the bolt which unites the coulter, share, mould board, and chip." This is of the number of those minor improvements which may be dismissed without animadversion.

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200. For an improvement in the mode of *Cutting off the Steam in Steam Engines;* Isaac Adams, Boston, Massachusetts, May 17.

The nature and object of the invention are thus described by the patentee:—

"My said invention consists of an addition to each end of the common slide valve in such manner as to form apertures through which the steam must pass in entering the cylinder; these apertures agree in dimensions with the induction apertures in the valve seat, (this valve I shall call the slide valve) and furnishing the outer surface of the slide valve with a sliding plate, or plain slide valve, which I shall call the cut off valve; the two valves are operated by two eccentrics, the one which operates the cut off valve being placed on the shaft with its most eccentric part in advance in the direction of its motion of the most eccentric point of the eccentric which operates the slide valve, so that the cut off valve is always brought to either extreme of its motion before the slide valve, and consequently returns in season to cover the aperture through the opposite end of the slide valve, and thus to cut off the communication between the steam chest and the interior of the cylinder at a half stroke, more or less, this circumstance being governed by the relative position of the two eccentrics in their orbit of rotation.

"The communication between the steam chest and the interior of the cylinder being thus cut off, the steam already in the cylinder will exert its expansive force upon the piston until it has reached one extreme of its motion, when the steam is allowed to escape from the cylinder as usual; and so on alternately.

"I claim the combination with steam engines of the slide valve having apertures constructed and operating as above described; and also the combination of the cut off valve with the slide valve, as above described and set forth. The purpose of the apparatus claimed being the working of steam expansively and in a more complete and advantageous way than has been

heretofore practised. I also claim the mode above described of giving the proper motion to the valves, viz. placing the cut off eccentric in advance of the slide valve eccentric, as above described."

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201. For an improvement in the *Truss for Hernia;* Samuel A. Brown, Petersburg, Virginia, May 25.

"The improvement consists in making the metallic strap which goes round the body, in three parts, united by two hinged joints at the sides; and a strap and buckle behind. In the centre of the middle piece is made an oblong mortise in which moves a slide to which the pad plate is attached.

"The invention claimed and desired to be secured by letters patent, consists in making the bands in three parts, hinged together, having in the centre of the middle piece an oblong mortise in which a slide or slides move, to which the pad plate or plates are attached, for adjusting the same to the ruptured parts, as before described." The two hinges mentioned are placed so as to come below each hip of the patient.

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202. For an improvement in the process of *Colouring Hats, Furs, &c.*; Harmon Hibberd, Attica, Genessee county, New York, May 25.

The process described in the specification of this patent is altogether empirical, as will appear to any one having a moderate acquaintance with chemistry. A mordant is to be prepared by putting into a large earthen pot, one quart of nitric acid, a quart of vinegar, three copper cents, and scraps of sheet tin sufficient to saturate the acids. When this is effected, another quart of vinegar is to be added, and the liquid is then to be bottled off for use. For each hat to be dyed, about a gill of this liquid is allowed, and a proportionate quantity for cloth or yarn. It is to be put into the dye kettle with a sufficient quantity of water for the number of hats to be dyed; these being put in, are to be boiled for about half an hour, with the addition of about six ounces of logwood for each hat, and a like quantity of sumack; these latter are to be boiled in a separate kettle until the extract is completed; the hats are then to be removed from the dye kettles, and the extract poured into it; one pound of pearlash is then to be added for every thirty gallons of the dye; the hats are then to be boiled for two hours in the liquid, when, it is said, they will commonly have a good black gloss.

To colour furs on the felt, the alkali is omitted in the dye, and they are prepared, after being tanned in sumach liquor, by brushing on the fur side a preparation made by boiling one pound of quicklime, and four ounces of red lead in one gallon of water, until half boiled away. This is to remain on an hour, and is then to be washed off; before the fur is dry, it is again to have the mordant brushed over it, and subsequently the dye, boiled down to double the strength above stated, is also to be brushed over it.

After certain observations which we shall not copy, the patentee claims "the using a fixed alkali in the composition of a dye, in the manner above described; likewise the mixing of nitric and acetic acids, and dissolving metals in the manner and proportions above described, to be used as a mordant, as set forth."

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203. For an improvement in *Fire Arms;* William Jenks, Columbia, South Carolina, May 26.

This is a gun which is to be loaded at the breech, by an arrangement of

the parts which appears to be convenient and simple; since obtaining the patent, the patentee has, however, made a new and much more perfect arrangement for effecting the same object, and has obtained a patent therefor; this we shall, in due course, present with the specification in full. The present claim is to "the combination of the slide, plug, and stop, as set forth."

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204. For an improvement in *Wheel Carriages and Harness;* Geo. Barnard, District of Columbia, May 25.

The patentee says that "a leading object and property of the invention is to facilitate the running of a carriage by attaching the wheels with a degree of mobility so that the shocks and irregular motions in passing over an uneven surface may not be directly received, but may be shared by the rest of the carriage. For this purpose, instead of the common stiff axletree, I make a separate axle to each wheel, bent down between the wheel and carriage, in the form of a crank, the two turns being right angles, or nearly such, making the direction of the arms, or parts on each side of the crank wrist, quite, or nearly, parallel. The inner and lower of these arms is fastened as a pivot under the carriage, thereby letting the arm which is the axis of the wheel swing, or rock back, to a certain extent, when the wheel is borne against a prominence, or impeded by any obstacle in its course."

The foregoing is one of the main features of the proposed improvement, but it will be seen, by the annexed claims, that several others are presented in his specification. This claim will furnish a pretty clear idea of the nature of most of them, and will probably contain as much on these points as most of our readers will desire. The arrangements manifest considerable ingenuity, but we apprehend their chance of general adoption is but small. Several of them have been anticipated to a considerable extent; still there is sufficient originality in the mode of effecting the object desired to justify the grant of a patent. The cranked axles, for example, are not new, axles perfectly similar in their action having been made in Albany, N. Y., about twenty-five years ago, at the suggestion of the late H. G. Spafford; and the late Stephen Van Rensselaer (the patroon) owned and rode in a carriage so constructed; the only difference between it and those now under consideration being that one cranked axle received the two wheels in the former, whilst the present patentee has a separate axle to each wheel.

The following are the claims:

"What I claim as of my invention, and wish to secure by letters patent, is comprised in the following nine articles, reference being had to the foregoing specification for particular descriptions.

1st. A separate crank shaped axle to each wheel of a carriage, with the lower arm thereof attached under the carriage, so as to roll, or turn, like a pivot, thereby making the upper arm, or axis, of the wheel movable, to a certain extent, in a sweep backward or forward.

2d. The method of affixing to the carriage a separate axle to each wheel, by the outward bearing sliding through an aperture, and the inward end being suspended from above, so as to let the axle slide, more or less, out from, or in under, the carriage, but not to let the part confined under the body move or twist backward or forward; thereby providing for the occasional running of either wheel, nearer to, or farther from, the carriage.

3d. The manner of hanging, or suspending, the body of a carriage herein

set forth, whereby it is allowed to move, or swing, forwards from its station whenever the wheels are resisted.

4th. The manner of suspending the body of a carriage by links, or straps, each pair of which are set nearer together at their upper than at their lower points of attachment, thereby holding the body in a position more nearly level than a right line between the stations on the ground of the two wheels, whenever one wheel of the pair is running on higher ground than the other.

5th. A carriage wheel, which may be elastic to any required extent, made with a spring steel rim, from the inner surface of which, at stations corresponding with the insertion of spokes into the rim of the common wheel, connexion is made to each end of the pipe which is to run upon the axis, by means of rods, or wires, of iron, or other metal, or straps, or cords, whereby the axis is always supported by suspension from the upper part of the wheel.

6th. The confining a spoke in the hub by a metal ring, the inside of which bears against a shoulder, cut for the purpose, on every spoke of the wheel.

7th. A leg for a hand cart, hung before its upper end, so that it may swing and glide over any obstacle struck by the foot when the cart is in motion, and having the upper end fitted to enter a cavity made for the purpose in the frame work of the body, directly over the leg, so that the whole may stand firm when the body is let down upon the leg, provision being made for the leg to run up into the cavity, by the axis of suspension being allowed room to glide downward, as far as may be required.

8th. Draught irons, such as hereinbefore described, applicable to the harness for carriages which have a part of their burden resting on the horse's back; that is, two wheel carriages. These draught irons are applied at the side of the horse, where the shafts are supported by the back bearing, and allow free action to the horse's shoulders by the draught strap, or chain, from the collar being attached to an iron, which, at each forward movement of the shoulder on that side, acts as a lever in slightly raising the shaft, or virtually shortening the back bearing.

9th. The application to harness for two wheel carriages of a steel, or iron, bar over the horse's back, resting on, or running through, the pad, or saddle, in place of the back band, or chain, commonly employed.

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205. For improvements in machinery for *Raising and Carrying Ships;* Hiram S. Meeker, and James Bergen, Jersey City, state of New Jersey, May 25.

The patentees say that "the nature of their invention consists in the construction of two vessels, which they call *carriers*, built of such shape that they will adapt themselves to the sides of a ship; that is, concave on the side applied to the ship to be lifted, and convex on the opposite sides. Each carrier is built sharp at its two ends, and partly in the form of a crescent, so that when not in use at ships' sides, or when about to be towed to the place where they are to be used, they may be joined together and be secured with heavy iron clasps." These carriers are furnished with chains passing through tubes leading down from their decks through their bottoms, and provided with windlasses by which they can be hove taught when passed under the vessel to be raised. When used for raising a sunken vessel, the

carriers are to be allowed to be filled with water, and sunk, so as to attach them to the vessel, when the water is to be pumped out from them.

"The invention claimed consists in the before described construction of the ship carriers in sections of the above form, so that they can be united by clasps in such a manner as to present the appearance of a double pointed boat, which can be towed, floated, or propelled with the machinery required to the place where said carriers are to be used, and then separated, and arranged on the sides of the ship or body to be raised, the chains passing under the same, and made fast to the windlasses on the carriers. Also the combination and arrangement of the pumps, valves, air tubes, windlasses, chains, and rollers, in the manner, and for the purposes set forth.

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206. For an improvement in *Refrigerators;* Henry V. Hill, District of Columbia, May 25.

(See Specification.)

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207. For a mode of *Fastening Hoe Handles*; George Hight, Gorham, Cumberland county, Maine, May 25.

The claim is to "the riveting the hoe plate to the shank plate, and securing the shank in the handle by means of a wedge and pin; or by a screw, in combination, as described." Modes of fastening hoe handles closely resembling that which is made the subject of this patent, have been long in use, but the case seems to have been one of those in which the identity of the modes was considered as a thing of doubt, and therefore the patent was granted.

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208. For an improvement in the *Mortising Machine*; John Andrews, Sudbury, Massachusetts, May 30.

We may remark of this, as we have repeatedly done of mortising machines, that the patent is granted for certain particular matters of arrangement not affecting the general construction of the machine. After the number of patents which have issued for such machines, it seems indeed almost impossible to discover a new species, and we look only for varieties of the old. In the present case the claims are to a "mode of setting the chisel for various depths, and the scale in combination therewith, as described, and also the index for setting the chisel at any angle, as described."

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209. For a *Churn*; Enoch Thomas, Harrisonburg, Rockingham county, Virginia, May 30.

The claims under this patent seem to have been put in for the mere purpose of making a claim, the general construction of the churn affording little or no foundation upon which one could rest. The box, or body of the churn, is to be placed upon rockers, and within it there are to be dashers, or divisions, formed of slats, for the agitation of the cream; in the lid there is to be a hole or opening left for ventilation; and we are told, contingently, that "wire gauze may be put over the opening to keep out flies," and the claim consists "of the wire gauze covering," and nothing more. The transition of this from a patented to an unpatented churn, and *vice versa*, may be, therefore, very quickly and conveniently made, nothing further being

necessary than to remove or replace a piece of wire gauze, which *may*, or may not be used.

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210. For a machine for *Mowing Grass, Grain, &c.*; Ira Wheeler, Salem, Rockingham county, New Hampshire, May 30.

The main feature of this machine consists of a cart (without a body) drawn forward by animal power, and to which, on one side, is suspended a frame containing a horizontal vertical wheel fixed on a revolving vertical axle, around which, at the bottom, are a number of horizontal scythes for cutting the hay, &c.; which, as fast as it is cut, "is carried round by fingers and deposited on a revolving endless apron in the rear of the same, which conveys it off at the end of the frame and lays it in win-rows, or, if grain, it is deposited by said apron into a box with a sliding bottom, by which it is dropped in gavels; said frame being raised and lowered so as to be adapted for the kind of cutting required, by pins inserted through posts of the frame into the shaft."

The wheel above spoken of is in the form of a reel, having two heads, and vertical rounds, or slats, extending from one to the other; on these rounds, or slats, the fingers are fixed, while the scythes are on the lower head. The claim is as follows:

"The invention claimed, and desired to be secured by letters patent, consists in the before described construction of the wheel for cutting grass, grain, and other articles, and depositing the same upon a revolving apron, which lays it in win-rows, or gavels; in combination with the inclined boards and fingers, box with sliding bottom, and levers and spring for drawing it out and in, as herein set forth. And it is to be understood that the parts separately are not claimed, but only in combination; and in the wheel, the heads and vertical axle are not claimed at all."

Most of the mowing machines which have been made have disappointed the hopes of their projectors, the operation being one of no small difficulty; we are well convinced that the one before us will not steer clear of the objections which have been found to exist in others that have had their brief day, and then expired.

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211. For improvements in *Saw Mill Dogs*; Hezekiah Thurber, Painted Post, Steuben county, New York, May 30.

The record of these improvements occupies nineteen pages, and we shall not attempt to give an epitome of the specification, nor shall we copy the claim, as this would not throw any light on the particular arrangements which form the ground work of the patent.

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212. For an improved *Windlass*; Russell Evarts, Madison, N. Haven county, Connecticut, May 30.

This windlass does not differ materially from others now in use, but there is some novelty in the manner of arranging and connecting certain parts by which the gearing is operated upon so as to increase, or otherwise regulate, the power applied; the claims are to these special arrangements.

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213. For an improved *Furnace for Smelting of Lead*; Robert A. Drummond, and G. W. Fuller, Galena, Jo-Daviess county, Illinois, May 30.

The smelting furnace which is the subject of this patent differs but little,

except in the proportioning of its parts, from the furnace ordinarily used in England for the same purpose; but the patentees aver that by the changes which they have made there is a substantial difference in the effect produced; and although a mere change of proportions is not a patentable improvement, yet when a new result is obtained by it, such a change becomes a legitimate subject for a patent. There is, however, as will appear by the claim, a provision for constructing the hearth so as to keep it at a comparatively low temperature, for the purpose of cooling the unsmelted part of the ore, and to prevent its running down with the lead; the latter remaining in a fluid form at a temperature lower than that which will solidify the fused ore, and, consequently, detain it on the hearth.

CLAIM.—"What we claim as our invention, and wish to secure by letters patent, is not the mere reduction in the general dimensions of the furnace when compared with what is known as the English furnace, but to such a mode of constructing and proportioning the respective parts, as above described, as promotes the separation of the lead from the mineralizers with greater facility and economy than have been hitherto attained; a result which is principally dependent upon the acceleration of the current of heated air in contact with the ore in the furnace. We also claim the manner of constructing the hearth of the furnace, as above described, by which we are enabled to keep it at a comparatively low temperature, which not only renders it very durable, but prevents the formation of slag, and causes also the grain, or unseparated particles of ore, to become chilled, preventing the running down thereof, whilst the reduced lead being in a perfectly fluid state, escapes readily; a result not obtained in the English furnace."

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214. For an improved mode of *Applying Friction to the Yarn Beam of the Power Loom;* Stephen Kimball, Pultney, Windham county, Vermont, May 30.

A friction belt, or belts, made of iron or steel, is applied to the cloth beam, and made to bear thereon with a force which is graduated by a regulating screw; and the claim made is "to the steel or iron spring constructed as described, in combination with the elliptic spring and warp beam, in the manner set forth."

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215. For an improved *Reacting Water Wheel*; Nelson Johnson, Erwin Centre, Steuben county, New York, May 30.

In this, as in most of the recent reacting water wheels, dependence for a new and great result is placed upon some trifling variation of shape; it is, in most cases, difficult to define these variations in words, and when this can be done, it is usually a loss of time to do it. In the present instance, we dismiss the thing with the claim to "the manner in which the buckets are constructed; that is to say, their descending curve from the top to the bottom of the wheel, and having their peripheries, or the outer rim of the wheel, cut away to allow of the free escape of the water, laterally."

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216. For *Facing Iron with Steel, for Sleigh Runners,* and tire for Wheels; William Johnson, Newark, New Castle county, Delaware, May 30.

The claim is to "the application of steel to the outer surfaces of the shoe,

or tire, by whatever process it is manufactured;" and we can scarcely conceive a more doubtful claim, as there certainly is neither invention or discovery, but the mere application of iron and steel, united by well known modes, to a purpose in which its application requires no special skill, or particular adaptation.

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217. For a *Circulating Sugar Boiler*; Francis Hoard, Boston, Massachusetts, May 30.

This patentee is now, it appears, a resident of Demerara, British Guiana, at which place, we suppose, he has his boiler in use; his American patent, however, can be available for the United States only.

This boiler, or series of boilers, have a metallic flue running under, and metallic tubes passing through them; the whole structure being of metal. The claims do not give much idea of the nature of the things claimed; they are to "the application of the within described flue, to the purpose of making sugar from suitable juices; the general modification of the entire apparatus to the purpose of making sugar, and the mode of charging forward the liquor, and taking off the sugar."

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218. For an improved *Boiler for Steam Engines*; Levin P. Clark, city of Baltimore, May 30.

"My steam boiler consists of a number of cylinders within which the water is to be contained; which cylinders I have arranged and connected together by tubes passing from one cylinder to another, in a manner which I believe to be substantially new." There are two rows of cylindrical boilers, one above the other, the fire being under the lower row, and the draft returning between it and the upper row. The steam chamber is formed by tubes rising vertically from the upper row of boilers, and by a horizontal tube into which they all enter; and the upper and lower row of boilers are also connected by tubes passing from one to the other. Each of the cylinders is supplied by a separate supply pipe. There is but little novelty in the whole affair, and the patentee is aware of this fact, but considers his particular arrangement as affording some substantial advantages, and claims "the combination and arrangement of these parts, taken as a whole, when made and constructed with the boilers arranged and connected with the steam tube, with the supply pipe, and with each other, specifically and substantially as set forth."

The foregoing claim, it will be seen, confines the patentee within the limits of his own construction, specifically; and it is believed that the case was one requiring this strict limitation, and that the office would not have been justified in issuing a patent under a claim more broad and general.

Specifications of American Patents.

Specification of a patent for an improved mode of Packing and Storing Ice. Granted to Frederick Tudor, *Boston, Massachusetts, May* 4, 1838.

Be it known, that I, Frederick Tudor, of Boston, in the county of Suffolk, and state of Massachusetts, have invented a new and improved mode of packing or storing ice, so as to diminish the wasting or decaying thereof:

and I do hereby declare that the following is a full and accurate description.

The nature of my invention consists in packing, or storing, in the following manner, by means of any non-conducting material which will fill the interstices of the blocks of ice, as is hereinafter mentioned, and exclude the atmosphere, to wit: The floor, or bottom, of the place where ice is to be stored, having been properly prepared, and the ice having been cut into blocks of convenient size, one layer of blocks is placed upon said floor, or bottom, and the interstices between said blocks are to be carefully filled with any nonconducting material, and a layer of said nonconducting material spread over the whole; a second layer of blocks is then to be put on the former layer, and all the interstices filled as before, and a layer of said nonconducting materials spread over the second layer, and so on until the required quantity is stored.

Various nonconducting materials may be employed for the purpose, such as sawdust, pulverized cork, rice chaff, or any other which may be preferred, and which may be adapted to the filling of the interstices between the separate blocks and layers of ice. The bottom and sides of the receptacle may be prepared in any of the ordinary modes of so doing; my improvement consisting entirely in the filling of the spaces usually left between the separate blocks of ice, with any suitable nonconductor, it having been found that by so doing, the ice is preserved from melting for a much longer period than usual.

What I claim as my invention, and wish to secure by letters patent, is the application of any nonconducting material as aforesaid, in the manner above stated, to the packing or storing of ice, thereby destroying or relieving the altitudinal pressure of vapours generated by the ice, and preventing the wasting, melting, and decaying of the same.

FREDERICK TUDOR.

Remarks by the Editor.—It will be admitted by all those who are acquainted with the career of the patentee, that he must be one of the best practical judges in the world of the most advantageous modes of stowing and transporting ice, as he has been the great transporter of icebergs to the torrid regions. It cannot be doubted that by excluding the air, or preventing the interchange of its particles among the blocks of ice, it will be more effectually preserved than without such precaution; but had the theory of its action been omitted in the specification, it would have been equally valid, and we should have been spared the attempt to guess what are the vapours generated by ice, whose *altitudinal pressure* affects it with consumption.

Specification of a patent for an improved method of Gilding Copper, Brass, &c. Granted to GEORGE R. ELKINGTON, *of Birmingham, Great Britain, May* 17, 1838.

To all whom it may concern: Be it known, that I, George Richards Elkington, a subject of the queen of Great Britain, and now at Birmingham, in the county of Warwick, in the said kingdom of Great Britain, have invented or discovered a new and "an improved method of gilding copper, brass, and other metals, or alloys of metal," and I, the said George Rich-

ards Elkington, do hereby declare the nature of my invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, (that is to say:) my invention consists in gilding copper, brass, and other metals, or alloys of metals, by means of potash, or soda, combined with carbonic acid, and with a solution of gold, as hereinafter described. And in order to my invention being most fully understood, I will proceed to describe the process as performed by me, and which has fully answered the purpose, the articles operated on having a very beautiful appearance, and in most instances are considered to be gilded far better than when similar articles have been submitted to the gilding process where quicksilver is used. The process of gilding by the aid of quicksilver being well known, and in general practice, and as it forms no part of my improved method, but is entirely different from my invention, no description of such process will be necessary in this my specification.

I will first describe the preparation of the materials, and then explain the process of using the same. Dissolve five ounces, troy weight, of fine gold, in 52 ounces, avoirdupois weight, of nitro-muriatic acid of the following proportions, videlicit, twenty-one ounces of nitric acid, pur. of 1.45 specific gravity—seventeen ounces of muriatic acid, pur. of 1.15 specific gravity, and fourteen ounces of distilled water. For this purpose, the gold being put into the mixture of acids and water they are to be heated in a glass, or other convenient vessel, till the gold is dissolved. And I usually continue the application of heat after this is effected, and until a reddish, or yellowish, vapour ceases to rise.

The clear liquid is to be carefully poured off from any sediment which generally appears, and results from a small portion of silver which is generally found in alloy with the gold. The clear liquid is to be placed in a suitable vessel, and I prefer the same to be of stone pottery ware. Add to the solution of gold, four gallons of distilled water and twenty pounds of bicarbonate of potash of the best quality; let the whole boil moderately for two hours. The mixture will then be ready for use. The liquid being thus prepared, and as in practice it is difficult to keep the liquid hot in stoneware vessels when many articles are being dipped, I have found it advantageous to transfer the liquid to a cast iron vessel, which it is necessary to keep very clean. The articles to be gilded having been first perfectly cleaned from scale, or grease, they are to be suspended on wires conveniently for a workman to dip them in the liquid, which is kept boiling.

The time required for gilding any particular article will depend on circumstances, partly on the quantity of the gold remaining in the liquid, and partly on the size and weight of the article; but a little practice will readily produce sufficient judgment to the workman. Supposing the articles desired to be gilded to be brass, or copper, buttons, or small articles for gilt toys, or ornaments of dress, such as earrings, or bracelets, a considerable number of which may be strung on a hoop, or bended piece of copper, or brass, wire, and dipped into the vessel containing the boiling liquid, above described, and moved therein, and the requisite gilding will be generally obtained in from a few seconds to a minute; this is when the liquid is in the condition above described, and depending on the quality of the gilding desired, but if the liquid has been used some time, the quantity of gold will be lessened, which will vary the time of operating to produce a given effect, or the colour required, all which will be quickly observed by the workman, and by observing the appearance of the articles from time to time, he will

know when the desired object is obtained; though it is desirable to avoid taking the articles out of the liquid as much as possible. When the operation is completed, the workman perfectly washes the articles so gilded with clean water—they may then be submitted to the usual process of colouring. If the articles be cast figures of animals, or otherwise of considerable weight, compared with the articles above mentioned, the time required to perform the process will be greater.

In case it is desired to procure what is called a dead appearance, it may be performed by several processes; the one I usually employ is to dead the articles in the process of cleaning, as practised by brass founders, and other trades, and it is produced by an acid prepared for that purpose, and sold by the makers, under the term deading aquafortis, which is well understood. It may also be produced by a weak solution of nitrate of mercury applied to the articles previous to the gilding process, as is practiced in the process of gilding with mercury, previous to spreading the amalgam, but generally a much weaker solution. Or the articles, having been gilded, may be dipped in a solution of nitrate of mercury, and submitted to heat to expel the same, as is practiced in the usual process of gilding. It is desirable to remark that much of the beauty of the result depends on the well cleaning of the articles, and it is better to clean them by the ordinary processes, and at once pass them to the liquid to be gilded. I have always employed the usual means for cleaning the articles from scales and other impurities, which are commonly resorted to in working of the metals for other purposes where the surfaces are required to be freed from scales, or other impurities, and I would remark that great care should be observed in purchasing the articles above described of the best description. I have described only the using of bicarbonate of potash, which I believe to be the best material for the purpose, and I would remark that soda, in a state of carbonate may be employed, as also some other preparations of potash and soda, but, so far as my experience goes, not with such advantages as potash in a state of bicarbonate, as above described.

Having now described the nature of my invention, and the manner of performing the same, I would have it understood, that, although in order to give the best information in my power, I have stated exact quantities of the articles employed, I do not confine myself thereto, nor do I claim any process for cleaning, or deading; but what I claim as the improved process of gilding, is the gilding copper, brass, and other metals, or alloys of metals, by means of potash, or soda, in the state of carbonate, or otherwise, and a solution of gold, as above described.

GEORGE RICHARDS ELKINGTON.

Specification of a patent for improved Refrigerators for the preservation of articles of food. Granted to HENRY V. HILL, *District of Columbia, May* 25, 1838.

To all whom it may concern: Be it known, that I, Henry V. Hill, of the city of Washington, in the District of Columbia, have invented an improvement in the refrigerators employed for the preservation of articles of food; by means of which improvement the metallic lining generally used is dispensed with, whilst the timber is rendered more durable, and the instru-

ment more effectually preserved from any offensive odour: and I do hereby declare that the following is a full and exact description thereof.

I construct a double box, or chest, in the usual way, interposing between the two pulverized charcoal, or any other bad conductor of heat, as has heretofore been done; but instead of lining the inner box, or chest, with zinc, or other metal, I saturate the wood with a resinous composition, which I cause the pores of the wood to imbibe by means of heat; the composition which I general use, and the means by which I apply it, are as follows:

I combine together about two parts of rosin and one part of beeswax, and by means of iron made as hot as can be admitted without actually burning the materials, I spread this resinous matter over the inside of the box, continuing the operation until I have forced as much of it into the pores of the wood as they will imbibe, and also leaving a thin coating thereof upon the surface. This preparation will effectually protect the wood from the action of water, and consequently from decay. I sometimes, especially when the refrigerator is to be kept in a damp place, coat the outside thereof with a similar resinous material, in the same way. The composition may also, if preferred, be applied to the exterior and interior of the boxes, or cases, constituting the refrigerator.

What I claim as my improvement in refrigerators, is the saturating and coating the wood of which they are constructed, with a composition of rosin and beeswax, or with any other resinous compound, similar in its properties, in the manner, and for the purpose, herein set forth.

HENRY V. HILL.

English Patents.

Specification of a patent granted to CHARLES WATT, *and* THOMAS RAINFORTH TUBBETT, *of Manchester, in the county of Lancaster, for their invention of certain improvements in the manufacture of the oxides of lead, and also of the carbonate of lead.* Sealed January 5, 1838.

I would first remark, that as carbonic acid does not combine with metallic lead when these bodies are placed in contact with each other, it is necessary that the lead should be converted into a protoxide, and subsequently into a carbonate; and as this fact is well known to all practical chemists, I shall proceed to describe our improvements in the manufacture of the oxides of lead, and also of the carbonate of lead, which consist of three different improved processes for obtaining the white hydrate of protoxide of lead, and converting the same into carbonate of lead; and I shall, therefore, describe these processes separately, and the manner of effecting the objects of our improvements.

Firstly, the metallic lead is to be converted into a protoxide or litharge, in the usual way of manufacturing the said oxide; in which state it may be purchased as an article of commerce, or manufactured as required; or we produce a hydrate of protoxide in the following manner:

We boil the protoxide, or litharge, with either of the chlorides of sodium, potassium, or barium, in a state of solution, in a suitable iron, or wooden,

vessel, heated by steam pipes, or other convenient manner, until the chlorine in these substances has passed into the oxide of lead, which is thereby converted into chloride of lead, which becomes perfectly white, when the process is properly conducted and perfected.

Having now obtained the chloride of lead, we proceed to produce the hydrate of protoxide from the same, by expelling the chlorine by means of sulphuric or nitric acid, thereby converting the chloride of lead into a protoxide of lead combined with either of these acids, which we effect in the following manner:

We take the chloride of lead, prepared as above stated, and red oxide, (usually called red lead,) in the proportions of three-fourths of the former to one of the latter: these are placed in a suitable vessel, or retort, and to them is to be added concentrated sulphuric acid, in weight equal to about one-third of the whole chloride and red oxide; and we then apply a gentle heat thereto, by means of steam, or in any other convenient manner; which heat is to be continued until all the chlorine is expelled, and the red oxide converted into a white sulphate. The vessel in which this operation is to be performed may be of cast iron, with an earthenware head, so constructed that the chlorine thus formed may pass into an apparatus, such as is usually employed in making the chlorides of lime, soda, &c.; such apparatus being varied according as the chlorides are intended to be made or formed in a dry or liquid state. We then remove the sulphate which has thus been produced into a wooden vessel, or tub, furnished with a cover, and well wash it with pure water, in order to remove therefrom any uncombined sulphuric acid, letting the waste water run off until that remaining with the sulphate is free from acid; we then add by degrees, and at intervals of about ten minutes, a solution of some alkaline or earthy carbonate, choosing such of the latter as are soluble in sulphuric acid, more particularly alumine and magnesia. While adding the solution of alkaline or earthy carbonate, we frequently or continually stir the mixture, continuing the process of pouring in the solution so long as any effervescence continues. The sulphate of lead has now become a white hydrate, containing much carbonate; and in order to ensure the perfect conversion of the whole into carbonate, we cause a current of carbonic acid to pass into the precipitate or mixture, and continue it for about an hour, keeping the vessel in which the operation is performed nearly closed, or covered with slight pressure on the lid, in order to obstruct the escape of the gas, the whole being occasionally agitated, or stirred, by any suitable means: the usual Woulfe's apparatus is best calculated for this operation, and may be made of wood, or earthenware. We generate carbonic acid gas in the usual way adopted for such purposes, which is too well known to require particular description. We then again wash the precipitate, or what may now be called white lead, several times with clear water, in order to remove therefrom the salts which have been formed by the chemical action: the process is now completed, and the white lead fit for use.

In our second process, we proceed as follows:—We take chloride of lead, and place it in an earthenware vessel, or such other material as is not acted upon by nitric acid, and which is furnished with suitable conducting off pipes and receiving vessels: the chloride of lead is here subjected to the action of nitric acid, equal in weight to about one-fourth of the chloride, which may be either concentrated or diluted to one-half, or two-thirds, of its former strength, adding fresh acid so long as any chlorine passes off from the chloride of lead into the vessels destined to receive it. The re-

tort, or vessel, containing the chloride of lead and nitric acid, must be furnished with all necessary pipes for applying the acid and conducting off the gas; and, as before stated, is to be constructed of earthenware, glass, or such material as is not acted upon by the acid. This process leaves the lead in the state of hydrate of protoxide, combined with a small portion of nitric acid; which hydrate of protoxide is to be converted into carbonate of lead, after the manner stated in the process first described, that is, beginning with the solution of alkaline carbonate.

Our next, or third process, is as follows:—We first dissolve metallic lead, finely granulated, or its protoxide, in nitric acid, diluted in about eight parts by weight of water, in a suitable vessel, as above stated, and apply a gentle heat thereto by means of steam, or in any other convenient manner, until all the lead is dissolved. We then precipitate the lead by any of the well known alkalies, or earths, in their caustic state: we prefer lime and barytes, because, by adding sulphuric acid to them, they will be precipitated in the solid form, leaving the diluted nitric acid free, to be applied to other useful purposes. We also use acetic acid for dissolving the protoxide of lead, following the same course as with nitric acid. After the precipitate or hydrate of protoxide of lead has been thus obtained, it is to be well washed with clear water, in order to remove therefrom the alkali or earthy salt, formed by the chemical combination: the precipitate is now a white hydrate of protoxide of lead. We then cause a stream of carbonic acid gas to pass into the hydrate of protoxide, by means of the well known apparatus called Woulfe's apparatus, which is formed of earthenware, or wood. The carbonic acid gas is generated or obtained in the usual or common method. The current of carbonic acid gas, upon the white hydrate of lead, is to be continuous, or nearly so, and the mixture is to be agitated by frequently stirring the oxide during the operation, which will be much facilitated if the hydrate and water are kept at about the temperature of 120 degrees. In our improved process, we avail ourselves of the combination of the protoxide of lead which takes place when it is boiled, with oily and fatty bodies, until they are converted into oleates, margarates, and stearates; which conversion or transformation is as well effected by oxide of lead as by any of the alkalies or earths. We then displace the protoxide of lead by an alkali, an earth, or their carbonates, which yield carbonic acid to the lead; while the base combines with the fat acids, a stream of carbonic acid gas being applied to the materials under operation, as before stated, for about an hour, in order to ensure the perfect transformation of the protoxide of lead into carbonate of lead; which carbonate is to be well washed from all adhering salts, or other extraneous matters, as before stated: or we may use diluted sulphuric acid, and boil the mass until all the protoxide of lead is precipitated as a white sulphate, which is to be formed into a carbonate, as already described.

In the foregoing processes, we do not claim the use of nitric acid or acetic acid, as solvents of lead, or its protoxides for the purpose of forming white lead; but we claim the use of sulphuric acid for converting the chloride of lead into a hydrated protoxide of lead, and afterwards into a carbonate of lead, and also the chloride of lead thus used. We likewise claim the precipitating the oxide of lead from the nitric and acetic acids, by caustic alkalies, or earths, instead of the carbonates, and afterwards removing them, and washing the precipitate before we form them into a carbonate of lead; and we claim the forming the hydrate of protoxide of lead, from whatever acid it is precipitated, into a carbonate of lead, and not, as in the

common way, precipitating it from a solvent by means of carbonates of alkalies.

We also claim the use of such particular earths, as lime and barytes, as the nitric and acetic acids may be recovered from them by the mere application of as much sulphuric acid as will just saturate the lime or barytes, and that these acids may then be employed for other useful purposes. We likewise claim the application of hydrate of protoxide of lead, formed, as described, from sulphate or hydrate of lead, for the purpose of being converted into a carbonate; and likewise the passing a current of carbonic acid gas through the hydrate, to effect its thorough transformation into carbonate. We likewise claim the use of the oleates, margarates, and stearates of protoxide of lead, as substitutes for acetic and other acids in the production of carbonate of lead, or white lead, for the purpose of converting the hydrate of protoxide of lead into carbonate of lead. Lond. Journ.

Specification of a Patent granted to EDWARD STOLTE, *of the county of Middlesex, for his invention of improvements in making sugar from sugar-cane, and in refining sugar.* Sealed 24th February, 1838.

The constituent parts of this invention are, the application of a new chemical agent, to be used for destroying any colouring matter that may be found in sugar. Animal charcoal has been very generally employed for this purpose for some time, and is now in very common use. The decolouring qualities of sulphurous acid are also already sufficiently known, and, therefore, need not be further noticed here; but another great advantage which may be derived from the use of this agent, for neutralizing the colouring matter in sugars which have been previously operated upon by lime, is, that the alkali is precipitated by the sulphurous acid, and prevents any fermentation of the saccharine matters from taking place.

The method employed for carrying this invention into effect, is described by the patentee in the following manner:—To the saccharine matters is added from one to two thousandth parts of lime, so that in a boiler containing one thousand pounds weight of juice, about two pounds of lime should be employed; and when the juice is boiling, the scum, or dirt, which rises to the surface, must be taken away, and twelve pounds of sulphurous acid in a liquid state (at four degrees of Beaume's areometer) is then to be poured in slowly, and with care; after which the juice is to be evaporated to about the thickness of twenty or twenty-two degrees, and afterwards passed through a filter, of flannel or other suitable substance, and concentrated until it arrives at the proper degree for crystallization.

In the first process of crystallization, it is necessary that great care should be observed that the syrup is not too thick, because if that attention is paid to the operation, a second crystallization may be obtained, which will yield from twenty to thirty per cent. of sugar, if the first process of boiling has not been pursued too far.

The process of refining sugar of a very bad quality must be modified in a slight degree, and somewhat after the following manner:—A very strong concentrated alcohol or spirit, charged with about two per cent. of sulphurous acid, is employed, and this is to be mixed with such a suitable quantity of saccharine matter, that a small portion only of the liquid will float upon the surface. The mixture is then to be stirred several times, and after about two hours the liquid should be drawn off, and the sugar washed in pure alcohol.

The molasses is dissolved by this process, and may be drawn off by a cock, and the pure and crystallized sugar being insoluble in alcohol, will remain beautifully white and clear in the vessel. The alcohol, or spirit, that has been used in the before-mentioned process of washing the sugar may be distilled from the molasses, and, of course, again employed for the same purpose. Ibid.

Specification of a Patent granted to William Barnett, *of the county of Sussex, for his invention of certain improvements in the manufacture of iron.* Sealed 10th July, 1838.

This invention consists simply in the adaptation of carburetted hydrogen gas, and the tar produced in the manufacture of such gas, together with atmospheric air, to the manufacture of iron. The hydrogen gas may be used either separately, or in combination with either the tar or a jet of atmospheric air, propelled with considerable force into the furnace by means of a force pump, or other suitable apparatus.

The patentee disclaims the use of carburetted hydrogen gas for the purpose of imparting certain qualities to the iron, and confines his claim of originality to the use of the gas, either separately, or in combination with either the coal tar or atmospheric air, merely for the purpose of economising fuel; and he does not lay claim to any particular form of apparatus to be employed to carry out the invention, as it is evident that the same must be considerably varied to suit places and circumstances. Ibid.

Specification of a patent granted to James Vincent Desgrand, *of the city of London, for a certain New Pulpy Product or Material to be used in Manufacturing Paper and Pasteboard, prepared from certain Substances not hitherto used for such purposes.*—Sealed May 15, 1838.

The object of the patent consists in making paper and pasteboard with wood, reduced into a state of paste; therefore my right of patent extends not only to the process of employing wood, but to the employment of the material itself. Among the different sorts of woods, I find that those which answer the best are those coming under the classification of white woods, such as poplars. I confine my patent to pure wood, exclusive of every possible bark or epidermis.

Process.—When the trees are entirely deprived of their bark or epidermis, they are cut in logs of about four to six feet long; these logs are split in pieces of about two to six inches each way; these pieces of about four to six feet long, and about two to six inches thick, are carefully assorted in their various shades or colour, as you can make at less expense white paper out of the whitest pieces, as well as you can make coloured paper without any addition of colouring matter; if these shades were wanted out of the shaded pieces, and by the addition of colouring matter, you can produce all sorts of shades requisite with the white and with the coloured pieces of wood. The above pieces of wood of four to six feet long, and two to six inches thick, are chopped in small chips of about two to four inches long, and one to three inches in thickness, taking care to chop them so as to make as many openings or splinters in the chip as possible; the more open they

are, the more freely they admit the liquor of which hereafter mention will be made, which liquor divides and separates the different fibres forming the texture of the wood. In doing the operation of chopping, it is necessary to reject all knots of the wood, all decayed parts, and all parts the fibres of which are not straight.

When you have a sufficient quantity of chips of one shade, they are deposited in a pit, water tight, in which there is an outlet for water, these pits being of a sufficient capacity to contain about half a ton of chips, then you pour over them, so that they should be entirely covered, what in France is known under the name of *lait de chaux*, which is in fact water saturated with lime as much as it will admit, the chips remain in that bath more or less according to the temperature. In the south of France, from three to six weeks were necessary to complete the action of the lime water, which action has for its object to dissolve the glutinous parts of the wood which keep the different fibres of the wood united together. You may be sure of the efficacy of the bath, when all the chips have sunk to the bottom of the pit, and not left any floating. When the chips are sufficiently dissolved, the saturated water is let out and replaced by a sufficient quantity of natural water, so as to wash away all the lime water, or as much as possible. In that state you may easily separate by the hand the fibres of the chips, but for employment they are submitted to the action of the stampers, or fulling mallet, to pound them; this pounding has for its object to open, divide, and flatten the fibres of the chips, and facilitate the further process they have to undergo in the usual paper engine or cylinder to reduce them into pulp. When the pulp is sufficiently reduced by the paper engine, it is in a fit state to make paper or pasteboard, either by itself, or mixed with the usual material generally employed for manufacturing paper or pasteboard, and you may employ it by a paper machine or by frames.

In using the paper engine, as now in operation, for preparing rags or other usual materials, care must be taken to employ the same sort of tackle, but use it very blunt or dull. If for white paper, the fibres, after they have been pounded and flattened and divided, are submitted to the action of the several chemical products which have the property of bleaching vegetable produce.

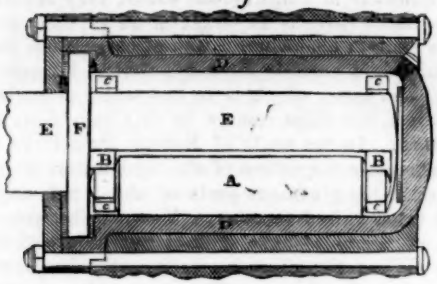
Rep. Pat. Inv.

Specification of the patent granted to JOHN BALL, *of Finsbury Circus, in the county of Middlesex, Merchant, for certain Improvements in Carriages.*—Sealed May 3, 1838.

The object of the invention is to decrease friction in the draft of wheel carriages, and consists of a mode of applying friction rollers to the axletrees of the wheels of carriages, and I would in the first place remark, that I am aware that friction wheels or rollers have before been applied to the boxes of the axletrees of wheel carriages in such a manner that they revolve with the axletree boxes, and around the axletrees. But according to this invention, the friction wheels are applied to the axletrees, and the axletree boxes revolve on the friction rollers, hence the friction rollers remain stationary as to position with the axletrees to which they are applied, and they reduce the friction of the axletree boxes by supporting such boxes, and touching at only a very small part of the inner circumference of each of the boxes, as will be fully described hereafter.

Description of the Drawing.—Fig. 1, is a longitudinal section of part of the nave of a carriage wheel, axletree box, and axletree, and the means of affixing the box in the nave, and also the means of fixing the axletree in the axletree box.

Fig. 1.



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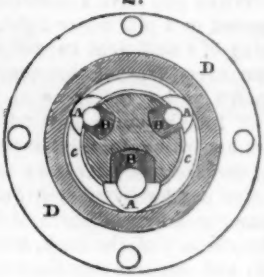

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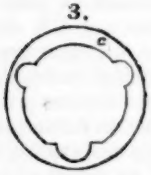


6.

5.

7.

4.

Fig. 2, is a transverse section of fig. 1; and,

Figs. 3, 4, 5, 6, and 7, are some of the parts shown separately. In each of the figures, the same letters indicate similar parts. A, A, A, are three friction wheels, which I prefer to be of steel, well tempered, and they should be accurately made, they having suitable necks formed at each end, on which they move as axes. B, B, are hollow bearings of steel or other suitable metal, which are let into the axletree E, there being suitable grooves or recesses formed in the axletree to receive them, and also to receive the rollers, A, in such manner that the rollers do not touch the axletree, they being simply carried by the bearings, B, let into the recesses formed in the axletree, as is clearly shewn in the drawing. C, C, are collars which have recesses or grooves formed for the necks or axes of the rollers, A; these collars, C, fit on to the axletree, and confine the rollers, A, thereto, allowing them to turn freely on their own axes or necks between the bearings, B, and the recesses in the collars, C. The axletree box, D, is cylindrical, the nature of which is shewn in the drawing; it should be accurately made and well hardened on the inner face, and the rollers, A, should each touch the box, and fit loosely therein, but capable of turning freely. *d*, is a screw to introduce oil for lubrication. F, is a fixed projecting ring on the axletree, and G, is a circular plate which retains the axletree in its place by means of four screw bolts, as is shewn.

Having thus described the invention, I would remark, that although I have shewn only three rollers, A, it is evident that more may be employed if desired, the invention not relating to the number of rollers employed, but only to the mode of employing the same, and I would have it understood, that what I claim as the invention is the mode of applying friction rollers to reduce the friction of the shaft of wheel carriages as herein described.

Ibid.

Specification of a patent granted to Louis Elisee Seignette, *of London, for improvements in preserving animal and vegetable substances, being a communication from a foreigner residing abroad.*—Sealed 21st March, 1836.

The patentee, in his specification, has described several modes of preserving animal and vegetable substances, but they are all founded upon the the same principle, namely, preventing oxygen from coming into contact with the substances to be preserved. The first process employed by the patentee is as follows:—He takes the meat, either raw or partly cooked, and places it in a solution of salt and nitre for from four to twelve hours, according to the size of the pieces to be preserved. The meat is then packed in tin cases, and the atmospheric air contained therein is to be exhausted by an air pump or otherwise, so as to form a partial vacuum, which must be filled up with a solution of salt and water, or brine; the tin case must then be reversed or placed head downwards in a vessel containing salt and water, and a quantity of carbonic acid gas is then allowed to run in from a pipe, or be pumped in, which will displace the salt and water; the tin case must then be fastened up in an air-tight manner.

The next method in which the patentee proposes to preserve animal and vegetable substances from decay, is somewhat similar to the above, and rather more advantageous. By this method he does not require any vacuum to be made by means of an air pump, but merely fills the tin case with brine when ready packed with meat, and then reverses it, as in the former process, in a vessel containing salt and water, and allows the carbonic acid gas to run into it; and to counteract or prevent the effects of any oxygen, a small bag of iron filings, or small pieces of iron, is put in the top of the case; and as the specific gravity of oxygen is less than that of carbonic acid, the oxygen will naturally rise to the upper part of the vessel, and enter into combination with the iron placed there for that purpose.

In the third process, the patentee dispenses with the use of salt and water and nitre altogether, and instead thereof he employs vinegar, in which he steeps the substances to be preserved; the tin cans are also filled with vinegar, which is displaced by the carbonic acid gas, as in the other process.

The patentee here observes, that it may be as well to introduce a small piece of calcined charcoal into the upper part of each case, to counteract or destroy any disagreeable smell that may arise.

In preserving fish, the patentee says it should be lightly salted, and treated in other respects in the same manner as other animal substances; and to preserve vegetables, they should be first plunged into boiling hot water, to preserve their form, and prevent them from changing colour.

Lond. Journ. Arts.

Specification of a patent granted to Joshua John Lloyd Margary, *of the county of Middlesex, for his invention of a new mode of preserving certain animal and vegetable substances from decay.*—Sealed 19th December, 1837.

The patentee states: I take sulphate of copper, which salt of copper I pre-

fer, being the cheapest, and to every pound avoirdupois I put five gallons of water, either warm or cold, but warm water will dissolve it soonest. When thoroughly mixed in a wooden or other suitable cistern, I let it run upon the substance that is to be acted upon, which, if timber or wood of any kind, should be fixed in a tank made of wood, or any suitable material, and allowed to remain in the solution two days for every inch of thickness, but to ensure durability, the longer time that large beams remain the better.

The timber should be submitted to the process in a perfectly dry state, in order that it may absorb as much of the solution as possible. Canvass should be immersed in the said tank in layers, the better to ensure complete saturation, and should remain in the solution till completely saturated, say for from eight to sixteen hours, according to its thickness, then put to drain, and afterwards hung up to dry, when it will be fit for use.

Rope is twisted so hard, that it would take a long time to saturate, and it is best saturated with the solution when in the state called strands, or of twine; and linen, or cotton, thread, or cloth, or woolen, or worsted yarn, I submit to the operation of the solution of the tank as aforesaid: paper may be spunged over with the solution on both sides, but it is best to mix the solution with the pulp: parchment, leather, and skins, I also place in the tank, and a very short time is sufficient for parchment to remain in the solution; when completely moist, it may be taken out and dried, and will be fit for use. Skins should remain in the solution, according to their thickness, from one to ten days.

Now, whereas, if acetate of copper be used, and acid should be employed to dissolve it, I should then mix one pound avoirdupois of acetate of copper with two quarts of pyroligneous acid and fourteen quarts of water, and then it may be used in the tank in the same manner as sulphate of copper, which dissolves in water, as before described. And, whereas, the certain substances to which I allude in the title of my said invention, are timber and wood of all kinds, canvass or other cloth, whether hempen, flaxen, cotton, or woolen, the threads also of which such cloth is wove; and rope, twine, hemp, flax, cotton, and wool, paper, parchment, leather and skins.

And, whereas, I claim as my invention, the wetting, saturating, steeping, or soaking, of the said substances with or in such solutions of sulphate of copper as aforesaid, for the purpose of preserving the same from decay.

Ibid.

Specification of a patent granted to Benjamin Cook, *of Birmingham, for his invention of an improvement in gas burners, commonly called or known by the name of Argand burners.*—Sealed 9th December, 1837.

The patentee states, that all Argand burners hitherto used for the consumption of gas, have had the apertures through which the gas passes at the top of such burners drilled in vertical directions, in order that the flame might ascend perpendicularly; he however, conceives that there would be an advantage in drilling the holes for the escape of the gas in the sides of the burners, or at least at considerable angles from the perpendicular.

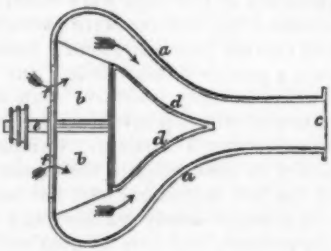
The advantages proposed are, that the flames issuing from the holes by these means would pass through a larger space, and be thereby enabled to consume a greater portion of the oxygen of the atmosphere, and, necessarily give out a greater degree of illumination, with an economised consumption

of the gas. The invention, therefore, consists solely in drilling or perforating the holes through the sides of an argand gas burner at any angle that may be found most eligible. Ibid.

Specification of a patent granted to Jacob Perkins, *of the city of London, engineer, for his having invented certain improvements in blowing and exhausting air, applicable to various purposes.*—Sealed 9th June, 1832.

This is a rotary blowing apparatus of a peculiar form, having the fans of the blower shaped like the section of a frustrum of a cone.

The annexed drawing exhibits the apparatus in section, consisting of an outer case, *a*, *a*, enlarged in the part where the rotary fan, *b*, *b*, is situate, and contracted into a nozle at *c*, for the purpose of guiding the volume of air intended to be forced into the furnace. There is also a partition *d*, *d*, forming the curved channel, as a guide to the blast.



The rotary fan, *b*, has four, or any other number of, vanes fixed radially upon an axle, *e*, which turns in bearings in the case, and is made to revolve by any convenient means. The atmospheric air passes into the apparatus through apertures at *f*, *f*, as shown by the arrows, and by the rotary action of the fan wheel *b*, is forced through the curved channel, and out at the nozle *c*.

This arrangement of the apparatus, it will be perceived, is only calculated for injecting a blast of air into a furnace, but a similarly contrived rotary fan might be adapted for exhausting the air, smoke, and vapour from the flues of a furnace, by placing the apertures *f*, *f*, in connexion with the flue, when the rotary action of the fan would draw the air, smoke, and vapour through the apparatus, and eject it at the mouth or nozle *c*. Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

Iveson's *Patent Mode of effecting the Combustion of Smoke.*

Smoke has always been regarded as a nuisance, and for a long time as a waste of fuel. As the age of steam advanced, and as its benefits were diffused over, and enriched the face of the earth, so did the concomitant evil, smoke, throw a cloud abroad, which bade fair to obscure the face of the sky. So great became the evil, that in process of time every one not directly interested in its cause complained aloud, and seemed willing to forego the

grand effects of the steam engine rather than put up with its smoke. Petition upon petition poured into the Houses of Parliament, praying the legislature to compel the manufactories to put out their fires or swallow their smoke. Learned societies offered premiums to incite their members to search for an antidote; chemists and mechanicians racked their brains to obtain the desired secret. A parliamentary committee was appointed to examine into the subject; and numerous were the plans which were brought under its notice, and described in the reports of its proceedings. An act was the result of this inquiry, rendering manufacturers indictable for a nuisance if the smoke of their chimneys annoyed their neighbours, and giving the judge power to compel the culprit to adopt any efficient plan for remedying the evil. This law has, however, never strictly been enforced, but the fear of its infliction compelled many to try and adopt various plans for either consuming or doing away with the offending vapour. Chimneys hundreds of feet high were built; hoppers, reverberatory furnaces, and numerous other devices were patented, or suggested, (not a few in our pages) and carried into operation. Some few succeeded, and are in use to this day; a greater number failed, and have gone to the "tomb of all the Capulets." Another incentive than that of fear of the law, has, however, been of late stirring up inventors to devise a plan to consume the smoke of the manufacturer's furnace. Competition has compelled the users of steam power to economise in the means of producing that power. The capability of the fuel to produce heat has been pushed to the utmost. Now the dregs —the smoke—only remains, and that must, and will, be turned to profitable account, and love of gain will effect what fear of loss could not accomplish.

If the expectations which have been raised in the present instance prove to be well founded, the bane has been found to carry with it its antidote—a small jet of steam seems to be all that is necessary to disperse a vast column of smoke. *Auld Reikie* is the birth place of the discovery now under notice; that city will now, mayhap, deserve this title no more; she will purify herself of her soot, and appear as fair as any city of the south.

For these last few weeks the papers and periodicals of the day have been teeming with paragraphs setting forth the enormous advantages of the grand discovery made by Mr. Iveson of Edinburgh, and detailing some strikingly important experiments stated to have been made by various eminent men upon the invention.

We are now enabled to present our readers with a correct description of Mr. Iveson's plan, to enable them to form a judgment for themselves upon its merits, and of its likelihood to answer the desired end. We confess that we are by no means satisfied that the advantages set forth as the result of the experiments are obtainable from the plan described. We think also that the theory by which it is endeavoured to account for the extraordinary result stated, that of a saving of forty per cent., is erroneous.

In the statement circulated by the patentee, the process is described to be "peculiarly simple, and of cheap and easy application, and may be adapted to any existing furnace in a short time. It consists in the admission of steam into the furnace, and discharged over the fuel at any expedient place. The best and easiest method is by the introduction of a pipe from the boiler above the door of the furnace, with a fan-shaped termination suitable to the size of the furnace, reaching beyond the dumb plate, and perforated with minute apertures, so as to throw the steam in small jets down upon and over

the whole breadth of the fire. The quantity required does not exceed one-tenth of the steam generated.

"The effect of the process is the prevention of smoke, and, *under proper management*, the creation of a great additional amount of heat. As the quantity of fuel is much diminished, it is necessary to contract the fire space considerably in height and width, but leaving the same surface of the boiler exposed to the fire; to raise the back bridge so as to contract the throat; and also, a little way beyond the bridge, to construct an inverted arch, which will propel the flame downwards, and precipitate the ashes. The lower part of the arch must be on a line with the upper surface of the bridge; and the space between them may be equal to that between the bridge and the boiler.

"As the introduction of steam into the furnace greatly increases the draft, it must, in other respects, be checked by every expedient means; it is necessary to work with the damper much lower than usual, and the great height of the chimney stack will be unnecessary. The fresh fuel should be placed, in the first instance, on the dumb or charring plate, so as to cause the flame and smoke to be exposed to the action of the steam."

We observed by the Edinburgh papers, that Mr. Iveson's plan had been applied to the *Royal Adelaide* steam ship, trading between Leith and London, and we looked forward with considerable interest for her arrival in the Thames to witness the working of the plan. We are sorry to have to state that the application has in this instance not succeeded. Perhaps the failure was owing to the difficulties and disadvantages always incident to first experiments and early workings of new operations; or it might be for want of the "proper management" stated in the preceding quotation to be necessary to obtain the great saving in fuel set forth as the result of the previous experiments; and if such be the case, we shall be happy to be able to publish the causes of the failure, if the parties interested think fit to supply us with them.

The boilers of the Royal Adelaide have one of the pipes, with fan shaped terminations to each furnace. During the whole of the voyage, the engineers experienced a great scarcity of steam for the engine, and about six hours more than the usual time were occupied in performing the voyage. The fire bars also were completely destroyed. The smoke, however, was almost entirely consumed. The furnaces were consequently restored to their original condition, and the Adelaide returned to Leith belching forth dark clouds of smoke as was her wont; nay, the smoke seemed even to rise higher, and spread abroad its murky shadow with renewed vigour, as if in triumph over the defeat of its would-be vanquishers.

Still, therefore, will the steamer's vapoury pennant roll in the breeze, and still will "the smoke that so gracefully curls," indicate the approach from the broad Atlantic of the steamship that, more truly than its rival, of which the words were written,—"Walks the water like a thing of life."

Lond Mech. Magazine.

On the Application of Anthracite for Smelting Purposes.

It is only a short time since the anthracite which is obtained in the south-west of Wales has been applied to the purposes of smelting, for although it does not decrepitate so violently as that from the neighbourhood of the Alps,

the different experiments which had been made, whether to burn it alone, or with a portion of coke, had not succeeded. The limit of three-fifths of anthracite to two-fifths of coke, could not be surmounted without decreasing the heat of the furnace.

It is only one year and a half since Mr. George Crane, of the Yniscedwyn Foundry, near Swansea, conceived the idea that the introduction of a current of warm air would remedy this inconvenience. The question was of double importance to that gentleman, as his furnace was situated in the anthracite district, whereas he was then obliged to use coal which had to be transported some distance. The first experiment, which he made in February, 1837, with anthracite only, succeeded admirably. Before speaking of the effect which the use of anthracite has upon the products of the furnace, I will mention a few circumstances relative to the occurrence of the material, and I shall conclude by examining the properties of the anthracite of Wales, compared with that of the Alps, in order to form an opinion whether that of France can be as successfully applied as that of England.

The greater portion of the coal basin of the south of Wales furnishes a mineral possessing considerable bituminous qualities, but gradually, as you approach the west, the coal measures become more dry, and the ten lowest beds, situated above the iron line, which is superincumbent on the millstone grit, furnish a material possessing all the properties of anthracite, and denominated, on that account, stone coal. This singular variation cannot be accounted for, as there is no rock of Plutonic origin in the department.

The mineral is hard, but it breaks easier than some varieties of anthracite from the department of Lamure. Generally it is of a black colour, passing into gray, with a semi-metallic lustre, vitreous, and conchoidal fracture, and does not soil or mark upon paper. When subjected to a temperature of 100°, the anthracite of Yniscedwyn yields 0.03 of pure water. A specimen, entirely free from pyrites, which was analysed by M. Regnault, yielded, after the reduction of 1.58 for the ashes which remained—

Hydrogen . . .	3.38
Carbon	94.05
Oxygen and azote . .	2.57—100.00

On being ignited, the anthracite of Wales burns with a clear, short flame, without smoke, but only of short duration. It then decrepitates, but the fragments retain their form. Some of the anthracite which is worked in the *brass vein* of Yniscedwyn, encloses a considerable proportion of iron pyrites, either in discernible or minutely disseminated particles. It is used promiscuously with the other varieties, if the metal is not required to be of the first quality; but if otherwise, it is previously calcined, in order to drive off a portion of the sulphur.

The mineral found at Yniscedwyn occurs in veins traversing schistus slate, and contains iron pyrites and phosphate of iron. An analysis afforded 0.004 as the mean proportion of the latter substance. The experiments relative to the anthracite were made in furnaces which were to be destroyed, on account of the surplus amount of combustible they consumed. The charge of three cwt., one half of which was coke, only carried three to three and a half cwt. instead of five to five and a half cwt. of ore, as in other furnaces. This circumstance is worthy of remark. As one blast serves for more than one furnace, I could not ascertain the volume or the current of the air employed; but the machine, recommended by Mr. Crane, for the purpose of supplying three furnaces constructed for anthracite, yields 10,500 cubic feet

of air, at the pressure of two and a half lbs. per cubic inch, equal to nearly twelve and a half centimetres of mercury; in the greater number of furnaces the pressure varies from two to two and a half lbs.

The air, before entering the tube, is heated to 620° Fahrenheit, by means of an apparatus slightly modified from that of Calder. All the data tend to prove that the principal difference between the advantages of the common furnace, and the corresponding work of a cold-blast coke furnace, is a considerable increase of temperature towards the base of the furnace. This is not only attributable to the heating susceptibility of anthracite, but also to its superior density. It is thought that these two circumstances ought to develop a much higher temperature than in any other case, as soon as a sufficient energy is afforded to the combustion; and for this purpose the hot air has been adopted.

Since the employment of anthracite, the proportion of foreign ingredients in the slag has been reduced to three-fourths its original contents.

Those of ordinary manufactures are generally vitreous, and the edges of the fragments are translucent. Of all the slag formed by high temperatures, these have the greatest tendency to crystallize. The fracture is generally of a vitreous nature, and greenish gray colour, with a lamellar appearance. In examining them attentively, I have observed small crystals disseminated throughout the mass, bearing the appearance of idocrase, or olivine.

The composition of the slag is as follows:—

Silex	44.6
Chalk	30.8
Magnesia	3.8
Alumina	15.8
Protox-iron	3.1
Sulphur	0.011—98.1011

This analysis resembles that of the slag obtained at Dowlais, but the temperature differs materially in the two cases. The principle of the introduction of hot air is to increase the susceptibility of combination, the air acquiring a considerable increase of chemical energy by the increase of warmth, so that it becomes disengaged from a great proportion of oxygen which it retains when cold.

Experience has shown, that the increase of intensity of the combustion has been the means of increasing the power much more than the diminution of the density of the air; consequently the temperature, which is proportionate to the quantity of combustible used in the same time, and in a similar space, ought to be much higher in the first case than in the second; in fact, the air being deprived of the oxygen, has a less degree of heat, and the uppermost particles do not acquire warmth except by means of the heat collected by the gas. From this, it appears, that a great heat ought to be concentrated, whilst the uppermost volume of air is less heated than in other furnaces.

The metal runs readily from the hearth; it is perfectly white, and possesses an almost perfect liquidity, which it retains for a longer time than ordinary. When cold, it is gray, fine grained, and easy to be polished. It is very tenacious, and Mr. Crane remarks, that it is about 25 per cent. more so than that which was obtained from the same furnace, and the same mineral formerly. It is rather astonishing, that the metal obtained with a combustible containing a larger proportion of pyrites than coke, should be so much superior to that commonly obtained by the ordinary means. This de-

sulfuration is the result of a greater increase of temperature. The sample of the slag which was analysed, contained merely 0.001 of sulphur; but judging from the smell of sulphuretted hydrogen which the slag gives out when rubbed with water, I am of opinion that the amount is more considerable.

This fact proves, that the metal obtained by means of hot air, is as tenacious as that produced under the same circumstances by the employment of cold air.

The quantity of carbon, silex, sulphur, and phosphorus contained in the metal smelted at Yniscedwyn, has been stated as follows:—

Carbon . . .	0.0230
Silex	0 0130
Sulphur . . .	0.0030
Phosphorus . . .	0.0048—0.0438

By the old method, four or five tons of coal, at the rate of 4s. 6s. per ton, were consumed to produce one ton of metal; but from the average of three months' observation, it appears that only 1 ton 7 cwt. of anthracite (not including that employed for heating the blast) was consumed. Anthracite of the best quality is worth 5s. the ton; but that which is commonly consumed averages only 3s. 6d., so that the quantity consumed has been reduced to the proportion of 18 to 5. This consumption of anthracite, in the proportion of 1.35 to 1. of metal, is much less than that of the furnaces in the neighbourhood, where coke is used; but it would appear, at first, that with a like temperature towards the base of the furnace, and a combustible material as compact, the gases originating from the combustion ought to be the means of a considerable loss of heat; but the effect of the hot air, as stated above, proves the contrary.

Thus we see how great are the advantages arising from the employment of anthracite in the manufacture of iron, whether as regards the economy, or the quality of the iron.

1st. It has brought into use a combustible mineral found in the neighbourhood, cheaper than bituminous coal, and consequently much less expensive than coke, and of which a much smaller quantity is required.

2dly. The quality of the iron has been sensibly improved by the use of it.

The anthracite found in many parts of France has not the identical properties of that of Wales, for the same effect has hitherto been unattainable in France.

It is known, that in the department of Isere, the mineral is found in the immediate neighbourhood of the fuel, and it was this circumstance which led to the experiments of 1833, but which have merely led to the scientific solution of the question.

The anthracite of Lamure contains—

Hydrogen . . .	1.75
Carbon	94.07
Oxygen and azote . .	4.18—100.00

which differs from the Welch anthracite, where the proportion of hydrogen is much larger. Though the results which have been obtained in the laboratory are unsatisfactory, they do not impede or nullify the possibility of

its employment in the blast furnace.—*M. Daubrée. Annales des Mines, vol.* 14. Min. Rev.

Photogenic Drawings.

"At the last sitting of the Academy of Sciences, M. Arago announced one of the most important discoveries in the fine arts that has distinguished the present century, the author of which has already acquired universal reputation by his miraculous diorama—M. Daguerre. It is well known that certain chemical substances, as chlorate of silver, have the property of changing their colour by the mere contact of light; and it is by a combination of this nature that M. Daguerre has succeeded in fixing upon paper prepared with it, the rays that are directed on the table of the camera obscura, and rendering the optical tableau permanent. The exact representation of whatever objects this instrument is directed to is, as every body is aware, thrown down with vivid colours upon the white skreen, prepared to receive them, and the rays of light that are thus reflected have the power of acting in the way above alluded to, on chlorate of silver, or certain preparations of it. In this manner an exact representation of light and shade, of whatever object may be wished to be viewed, is obtained with the precise accuracy of nature herself, and it is stated to have all the softness of a fine aqua-tint engraving. M. Daguerre had made this discovery some years ago, but he had not then succeeded in making the alteration of colour permanent on the chemical substance. This main desideratum he has now accomplished, and in this manner has been able, among other instances, to make a permanent chemical representation of the Louvre, taken from the Pont des Arts. M. Arago, in commenting upon this most extraordinary discovery, observed that a patent would be by no means able to preserve the rights of the discoverer sufficiently to reward him for his efforts; and he therefore urged the propriety of an application being made to the legislature for a grant of public money as a recompense. M. Biot, on the same occasion, compared M. Daguerre's discovery to the retina of the eye, the objects being represented on one and the other surface with almost equal accuracy.

"What is the secret of the invention? What is the substance endowed with such astonishing sensibility to the rays of light, that it not only penetrates itself with them, but preserves their impression; performs at once the function of the eye and of the optic nerve—the material instrument of sensation and sensation itself? In good sooth we know nothing about it. Figure to yourself, says a Parisian contemporary, a mirror, which, after having received your image, gives you back your portrait, indelible as a picture, and a much more exact resemblance. Such is the miracle invented by M. Daguerre. His pictures do not reproduce colour, but only outline, the lights and shadows of the model. They are not paintings; they are drawings; but drawings pushed to a degree of perfection that art never can reach.

"One has heard of writing by steam, but 'drawing by sunshine' (or moonshine) is a novelty for which the world is indebted to M. Daguerre, of Paris, the diorama painter. M. Arago and M. Biot, who have made reports to the Academy of Sciences on the effect of M. Daguerre's discovery, have given up all attempts to define its causes. The complaisance of the inventor has permitted us to see these *chefs d'œuvre*, where nature has delineated herself. At every picture placed before our eyes we were in admiration.

What perfection of outline—what effects of *ciaro obscuro*—what delicacy—what finish! But how can we be assured that this is not the work of a clever draughtsman? As a sufficient answer, M. Daguerre puts a magnifying glass in our hand. We then see the minutest folds of the drapery, the lines of a landscape, invisible to the naked eye. In the mass of buildings, accessories of all kinds, imperceptible accidents, of which the view of Paris from the Pont des Arts is composed, we distinguish the smallest details, we count the stones of the pavement, we see the moisture produced by rain, we read the sign of a shop. Every thread of the luminous tissue has passed from the object to the surface retaining it. The impression of the image takes place with greater or less rapidity, according to the intensity of the light; it is produced quicker at noon than in the morning or evening, in a summer than in winter. M. Daguerre has hitherto made his experiments only in Paris; and in the most favourable circumstances they have always been too slow to obtain complete results, except on still or inanimate nature. Motion escapes him, or leaves only vague and uncertain traces. It may be presumed that the sun of Africa would give him instantaneous images of natural objects in full life and action."

The invention has since been the subject of discussion at the Royal Institution in London; and we have been told that in some of the specimens exhibited, so perfect was the resemblance of the picture produced to the original, that the very threads and fibres of a person's garments were plainly shown.

Lond. Mech. Mag.

Photogenic Drawing.

The subject (says Mr. Talbot) naturally divides itself into two heads—the preparation of the paper, and the means of fixing the design. In order to make what may be called ordinary photogenic paper, the author selects, in the first place, paper of a good firm quality, and smooth surface; and thinks that none answers better than superfine writing paper. He dips it into a *weak* solution of common salt, and wipes it dry, by which the salt is uniformly distributed throughout its substance. He then spreads a solution of nitrate of silver on one surface only, and dries it at the fire. The solution should not be saturated, but six or eight times diluted with water. When dry, the paper is fit for use. He has found, by experiment, that there is a certain proportion between the quantity of salt and that of the solution of silver which answers best, and gives the maximum effect. If the strength of the salt is augmented beyond this point, the effect diminishes, and, in certain cases, becomes exceedingly small. This paper, if properly made, is very useful for all ordinary photogenic purposes. For example, nothing can be more perfect than the images it gives of leaves and flowers, especially with a summer sun. The light passing through the leaves, delineates every ramification of their nerves. If a sheet of paper, thus prepared, be taken and washed with a *saturated* solution of salt and then dried, it will be found (especially if the paper has been kept some weeks before the trial is made,) that its sensibility is greatly diminished, and, in some cases, seems quite extinct. But if it be again washed with a liberal quantity of the solution of silver, it becomes again sensible to light, and even more so than it was at first. In this way, by alternately washing the paper with salt and silver, and drying it between times, Mr. Talbot has succeeded in increasing

its sensibility to the degree that is requisite for receiving the images of the camera obscura. In conducting this operation, it will be found that the results are sometimes more, and sometimes less satisfactory, in consequence of small and accidental variations in the proportions employed. It happens sometimes that the chloride of silver is disposed to darken of itself, without any exposure to the light—this shows that the attempt to give it sensibility has been carried too far. The object is, to *approach* to this condition as near as possible, without *reaching* it; so that the substance may be in a state ready to yield to the slightest extraneous force, such as the feeble impact of the violet rays, when much attenuated. Having, therefore, prepared a number of sheets of paper, slightly different from one another in the composition, let a piece be cut from each, and, having been duly marked or numbered, let them be placed side by side in a very weak diffused light, for about a quarter of an hour; then, if any one of them, as frequently happens, exhibits a marked advantage over its competitors, Mr. Talbot selects the paper which bears the corresponding number to be placed in the camera obscura.

With regard to the second object—that of fixing the images—Mr. Talbot observed, that, after having tried *ammonia*, and several other re-agents, with very imperfect success, the first which gave him a successful result, was the iodide of potassium, much diluted with water. If a photogenic picture is washed over with this liquid, an *iodide of silver* is formed, which is absolutely unalterable by sunshine. This process requires precaution; for, if the solution is too strong, it attacks the dark parts of the picture. It is requisite, therefore, to find, by trial, the proper proportions. The fixation of the pictures in this way, with proper management, is very beautiful and lasting. The specimen of *lace* which Mr. Talbot exhibited to the Society, and which was made five years ago, was preserved in this manner. But his usual method of fixing is different from this, and somewhat simpler —or, at least, requiring less nicety. It consists in immersing the picture in a strong solution of *common salt*, and then wiping off the superfluous moisture, and drying it. It is sufficiently singular, that the same substance which is so useful in *giving* sensibility to the paper, should also be capable, under other circumstances, of *destroying* it; but such is, nevertheless, the fact. Now, if the picture which has been thus washed and dried, is placed in the sun, the white parts colour themselves of a pale lilac tint, after which they become insensible. Numerous experiments have shown the author that the depth of this lilac tint varies according to the quantity of salt used, relatively to the quantity of silver; but by adjusting these, the images may, if desired, be retained of an absolute whiteness. He mentions, also, that those preserved by *iodine* are always of a very pale primrose yellow, which has the extraordinary and very remarkable property of turning to a full gaudy yellow, whenever it is exposed to the heat of a fire, and recovering its former colour again, when it is cold.

Brit. Assoc.—Atheneum.

On the Construction of Apparatus for Solidifying Carbonic Acid, and on the elastic force of Carbonic Acid Gas in contact with the liquid form of the Acid, at different Temperatures. *By* Mr. Robert Addams.

Mr. Addams prefaced his communication by adverting to the original production of liquid carbonic acid by Dr. Faraday, in 1823, and also to the solidifi-

cation of the acid by M. Thilorier, and then exhibited three kinds of instruments which he (Mr. Addams) had employed for the reduction of the gas into the liquid and solid forms. The first mode was mechanical, in which powerful hydraulic pumps were used to force gas from one vessel into a second, by filling the first with water, saline solutions, oil, or mercury; and in this apparatus a "*gauge of observation*" was attached, in order to see when the vessel was filled. The second kind of apparatus is a modification of that invented and used by Thilorier. The third includes the mechanical and the chemical methods, and by which, as stated, a saving of a large quantity of acid formed in the generator is effected; whereas, by the arrangements of Thilorier's plan, two parts in three are suffered to rush into the atmosphere, and are lost. With this set of instruments are used two gauges of observation—one to show when the generator is filled with water by the pumps, and consequently all the free carbonic acid forced into the receiver; and the other to determine the quantity of liquid acid in the receiver. He likewise exhibited other instruments for drawing off and distilling liquid carbonic acid from one vessel into another, and mentioned some experiments which were in progress, and especially the action of potassium in liquid carbonic acid,—an action which indicated no decomposition of the real acid, but such as implied the presence of water, or a hydrous acid. A table of the elastic force, or tension of the gas, over the liquid carbonic acid, was shown, for each ten degrees of the thermometer, beginning at zero, and terminating with 150 degrees. The following are some of the results:—

Degrees.	lb. per sq. inch.	Atmospheres of 15 lb each.
0	279.9	18.06
10	300.	20.
30	398.1	26.54
32	413.4	27.56
50	520.05	34.67
100	934.8	62.32
150	1495.65	99.71

Mr. Addams announced his intention of examining the pressure at higher temperatures, up to that of boiling water, and above; and asserted his belief that it may be profitably employed as an agent of motion—a substitute for steam—not directly, as had been already tried by Mr. Brunel, but indirectly, and as a means to circulate or reciprocate other fluids. The solidification of the acid was shown, and the freezing of pounds of mercury in a few minutes, by the cooling influence which the solid acid exercises in passing again to the gaseous state. Ibid.

On the Possibility of obtaining, by Voltaic Action, Crystalline Metals, intermediate between the Poles or Electrodes.

These observations were in connexion with, and in support of, those laid before this Section last year, by the author, on the same subject.

After drawing the attention of the members to the important influence

exercised by electric currents, and the probability of their affording some insight into the mysteries of the formation of mineral veins, Dr. Bird alluded to the results of the experiments detailed by him at Liverpool, and observed that certain sources of fallacy existed, which he had not then been able to obviate, and which rendered the results less satisfactory; and after making a rapid sketch of the experiments of Fox and others, and pointing out their generally interesting, although unsatisfactory, nature, he proceeded to describe a form of apparatus arranged by Mr. Sandall, of St. Thomas' Hospital, by the aid of which he had obtained results which he considered as conclusive in favour of the possibility of the reduction of a metal intermediate between poles or electrodes. The apparatus consisted of a jar furnished with a *vertical* diaphragm of plaster of Paris, instead of a *horizontal* one, which Dr. Bird had previously used. In one cell of the jar was placed water, and in the other a solution of sulphate of copper. On immersing a compound arc, so that the zinc leg might dip into the water, and the copper leg into the metallic solution, an electric current of course ensued; and at the end of a month the solution of copper became nearly decolorated. On breaking up the apparatus, scarcely any crystals of copper were found on the negative electrode, whilst that surface of the plaster diaphragm bathed by the sulphate of copper, was covered with the reduced metal in a nodular or stalagmitic form. Specimens of the plaster covered with the copper were exhibited; they were exceedingly perfect, as far as metallic lustre and every required character were concerned; differing from those shown by Dr. Bird at Liverpool, in their want of crystalline surface. On breaking the mass of plaster crystals, little veins of copper were found disseminated through it in every direction, presenting a most marked resemblance to those met with, on the large scale, in nature.

Prof. Whewell observed, that the facts brought forward bore more directly upon the production of metallic veins, than any yet laid before the scientific world; and he stated, that, in his opinion, they were conclusive in favour of the important Faradian law—that the passage of an electric current was capable of effecting decomposition of compound bodies without the presence of poles or attracting surfaces. Ibid.

On the Influence of Voltaic Combination on Chemical Action. By Dr. Andrews.

In dilute sulphuric acid, composed of one atom of the dry acid and eight atoms of water, the solution of distilled zinc is permanently accelerated, by connecting it with a plate of platina immersed in the same liquid, so as to form a voltaic combination. In acid containing seven atoms of water, the ordinary action is at first increased, and afterwards rather diminished by contact with platina. But when zinc is heated in acid containing less than this quantity of water, the connexion with platina transfers the evolution of gas, from the surface of the positive to that of the negative metal, and at the same time diminishes its quantity, and consequently retards the rate of solution of the zinc. The formation of a galvanic circle exerts, therefore, a reverse effect on the solution of zinc in sulphuric acid, containing more or less than seven atoms of water. The principal circumstances which influence these results are, the adhesion of the hydrogen gas to the surface of the zinc; the formation of sulphate of zinc, which is greatly facilitated by the presence of seven atoms of water in union with each atom of acid (that

being the number of atoms of water of crystallization contained in it;) and lastly, the proper action of the voltaic circle, which tends to diminish the solution of the zinc. In dilute acid, the first circumstance retards the action on the zinc alone, and the second facilitates its solution; then the platina surface enables the hydrogen to escape. But in the stronger acid, the voltaic association impedes the solution of the zinc, partly from the evolution of gas being transferred to the platina, and thus the saturated liquid being allowed to accumulate around the zinc plate; and partly from the real effect of the galvanic combination. That the proper tendency of a voltaic circle is, to diminish the chemical action of the solution on the electro-positive metal, the author endeavoured to show, from the consideration, that in ordinary solution the electricities thus developed have only an indefinitely small portion of liquid to traverse, while in voltaic solution their reunion can only be effected by passing across a column of variable extent, and composed of an imperfectly conducting substance. And, as the action is greater the nearer the plates are to each other, that action ought to attain a maximum when the distance between the plates vanishes, provided this condition could actually be realized. Idem.

Papier Maché Ornaments, for the "Acteon," Liverpool and Glasgow Steam ship.

We have been favoured, within the last few days, with an inspection, at the manufactory of Messrs. Jennens and Bettridge, of a set of panels in *papier maché*, intended for the decoration of the "Acteon," Liverpool and Glasgow steamer; which, as works of art, have not, we believe, been surpassed by any thing of the kind ever produced at this celebrated establishment. The panels are 28 in number, four of which are very large, and consist of historical subjects, some original, and others copies from the works of celebrated masters. The first represents the triumphal entry of Alexander into Babylon; the second exhibits a view of a Grecian seaport, and the arrival of a victorious fleet; the third describes the Olympic games, the combats of gladiators, &c.; the fourth gives a representation of the Hippodrome, the Temple of Victory, and chariot races. Each of these subjects is depicted by the artist with the vividness and freshness of life. The various groups of Grecian, Egyptian, and Persian figures, the richness and brilliancy of the costumes, the colossal statues, temples, and columns, in their architectural grandeur and beauty, furnish a vivid representation of the barbaric pomp and magnificence of by-gone ages. The smaller panels are divided into the classes, devoted to the illustration of particular subjects. The first series represents full length figures emblematic of Victory, Commerce, and the Arts and Sciences, surrounded with beautiful ornamental work, drawn in imitation of *alto-relievo;* the whole surmounted with the arms of Liverpool and Glasgow. The second embraces mythological subjects, representing the triumph of Neptune, Juno, and the Graces, Actæon, &c.; the whole adorned with an emblematic frame work. The third comprises mosaic heads, and emblems ornamented with arabesque foliage, brds, flowers, and fountains. Viewed separately, each of these paintings is an exquisite specimen of the advanced state of this department of our manufactures and the fine arts; and, as a whole, they form unquestionably one of the most unique and splendid collections of the kind ever produced. The panels will not, we believe, be removed for a few days from the show rooms of

the manufactory, where artists and other visitors may have an opportunity of inspecting them.—*Birmingham Herald.* Lond. Mech. Mag.

Kiln Drying Wheats for Grinding.

We have been lately struck with a passage in the last Quarterly Journal of Agriculture, recommending the process of kiln drying wheats, as applied in Scotland and the North of England to oats. "It is evident," observes the writer, "that all grain intended for household consumption can be readily preserved; but that all meal is less easily kept from the attacks of insects, and is with greater difficulty recovered from the deterioration. We incline to think that the vast superiority of Scotch oatmeal over that which the unfortunate Southerns obtain from English millers, and the great length of time during which the former will remain sweet and good compared with the latter, which will keep useable only a fortnight, is attributable to the method of kiln drying that the Scotch millers adopt, which not only destroys incipient (or perhaps actual) insect vitality, but imparts that richness of flavour which is wholly deficient in English oatmeal. In fact, the mealmen of the South confess they know not how to give the same appearance, taste, scent, or texture, to their oatmeal, that is so apparent and so delicious in that of Scotland.

"We are firmly of opinion that if wheat could be subjected to a similar process to that which is adopted for oats, the results would be the same, namely, that it would keep a much longer time; it would be secured from insects; its flavour would be highly improved in richness and delicacy; it would be decidedly more wholesome, and would require much less time in cooking. Our reasons for speaking thus positively arise from actual demonstration. It is well known that flour from wheat is rejected altogether by the dyspeptic, 'because it lies heavy on the stomach,' 'because it turns sour,' 'because it ferments,' 'because'—twenty other reasons; therefore it is not a fit aliment for young children, where, from ill health or fortuitous circumstances, a mother is unable to nurse her offspring, and recourse is had to extraneous nourishment. Every succedaneum with which we are acquainted has been tried for the food of infants, and not any is so entirely free from objection as this very contemned *wheaten flour*, when it has undergone the process of either baking or boiling for the space of a couple of hours. All crudity is then subdued—it becomes a compact hard mass, which is to be rolled or grated when wanted for use—requires merely heating, not even boiling, to make it palatable, and is in flavour really delicious; it is also light, nourishing, free from all those objections made by the dyspeptic, and moreover will keep free from insects, shall we say *for ever?* if we do, our readers will see that we mean an indefinite period." Ibid.

Reagent for the Detection of Sulphurous Acid, in the Hydrochloric Acid of Commerce. By GIRARDIN.

The hydrochloric acid of commerce often contains sulphurous acid, especially when prepared on the large scale in the alkali manufactories: this contamination cannot be detected by the odour, but in the protochloride of tin we have an excellent test for its presence. For this purpose, crystals

of the chloride should be dissolved in the suspected acid, which, if free from sulphurous acid, will dissolve the chloride, with the production of a very insignificant troubling. If this acid is present, however, the hydrochloric acid becomes rapidly brown, by repose depositing a precipitate of that colour, consisting of an intermediate sulphuret of tin, of protosulphuret, and of chloride of tin insoluble in muriatic acid. This reaction depends upon a portion of the tin becoming oxidated at the expense of the sulphurous acid, another portion uniting with the sulphur, while the oxide of tin thus formed dissolves in the excess of muriatic acid to form an insoluble chloride.—*Journ. für Pract. Chemie.*, 6. 81. Edin. N. Philos. Journ.

Progress of Physical Science.

An account of a series of daily Observations, made by Andrew Crosse, Esq., *of Broomfield, near Taunton, with a Sustaining Voltaic Battery, to ascertain the increase or diminution of the power of the same, as corresponding with the increase or diminution of the temperature of the atmosphere, during a part of the last winter, and commenced previously to the very severe frost which afterwards took place. Also a few remarks on the agency of heat in electro-crystallization.* Read June 19th, 1838.*

For upwards of two years past, I have found it convenient, in the formation of crystalline and other matters, by the electric agency, to make use of porous earthen pots, of the same nature as garden pots; but without an aperture in the bottom. One of these being filled with a compound fluid, A and B, and being plunged in a basin filled with another compound fluid, C and D; A of the one fluid having a greater chemical affinity (as it is called) to C of the other fluid, than it has to B, with which it is united, and also B to D, so that by the admixture of the two fluids, double decomposition would take place; an electric current being passed, by means of primary conductors proceeding from the poles of a voltaic battery in constant action from one fluid to the other, through the pores of the pot employed, a slow union of A and C, or B and D, or both, takes place, either at the positive or negative pole, or on the inside or outside, or *within the substance* of the pot itself; or in more than one, or in all of these, according to the *nature* and *temperature* of the fluids employed, the *intensity* or *quantity* of the electric current, the thickness of the pots, and the presence or *absence of light*, which last is in most cases of greater or less importance, and in some absolutely essential. The result of this union is common to the production of regularly or irregularly formed crystalline matters, more or less firmly adhering to substances upon which, or within which, they are formed. I have used these pots in hundreds of experiments, in an infinite variety of applications, and with considerable success. I have likewise used them more or less extensively in the place of bladder in sustaining voltaic batteries, for which purpose they are admirably suited. They have, however, one defect. If,

* From the Transactions of the London Electrical Society.

while sulphate of copper is used for the negative cells, a neutral salt be employed for the positive, in the course of time crystallizations are formed within the substances of the earthenware which separates the two fluids, and the pots are cracked in all sorts of forms—sometimes longitudinally; sometimes laterally; sometimes in concentric layers; the outer or inner portions scaling off like the bark of a tree; and sometimes in small angular or circular fragments, which start off with a slight explosion, so that after some months' action, the earthen vessel is spotted over with deep indentions, either external or internal, or both. It is therefore safer and better, on all accounts, to avoid the use of neutral salts in the positive cells, which I commonly fill with simple water, when I wish to keep up a uniform action for a considerable time, and when I employ these pots merely in the place of bladder.

The following observations were made in a room exposed to the light, with a southern aspect, and situated about 800 feet above the level of the sea—

Dec. 22, 1837. 10 P. M. I set in action a small sustaining battery composed of twelve two-inch square arcs of zinc and copper, (the zinc not amalgamated) in small porous pots and glass basins; each zinc plate resting on a small piece of zinc, placed in a glass basin filled with common water; and each copper plate resting on a larger piece of copper placed within a pot which stood in the middle of the next glass basin, and which contained three ounces of sulphate of copper and water. It is a simple and economical mode of increasing the surface of the metals employed, to cause the pairs of plates to rest respectively on larger masses of the same metals, by which means small plates may be made to act in some degree with the power of large ones, and which partially saves the expense and trouble of casting. A Faraday's voltameter being filled with common pond or river water, was connected with the poles of the battery, and emptied of its gas each night at 10 o'clock, and replaced in its former situation. A thermometer was likewise suspended above the battery, so that its bulb was immersed in one of the glass basins of water. This thermometer was examined at different intervals during the day and night, and the degrees of temperature carefully noted. It is obvious that by this arrangement only a portion of the electric fluid excited could possibly pass through the voltameter, as no acid was added to the water with which it was filled. For this I had reasons which I shall not here dwell upon.

The observations were continued for the space of one month, or twenty-eight days, during which time neither water nor sulphate of copper was added to the cells of the battery, in consequence of which a good deal of the fluid had evaporated at the month's end. When the voltameter was first applied, a very small stream of the combined gases was extricated, but in the course of some hours it increased, and at the end of twenty-four hours 42-20ths or degrees of gas were evolved. It will be seen by inspecting the journal attached, that the battery did not arrive at its maximum of power till the third day from the commencement of its action. This was occasioned by the resistance of the earthen pot to the electric current, a thicker or a thinner pot affording a greater or a less resistance. It will likewise be seen that in general there was a more or less regular decrease of power, which seemed to be at the rate, as near as one may judge, of from one to two degrees of gas in twenty-four hours, supposing the temperature to remain the same; but that in general the power increased or diminished with the increase or diminution of temperature. Thus in the first week, as long as the thermom-

eter stood at about 50, the diminution of gas was from one to two degrees in each day; but on the last day of the year, when the thermometer had sunk from 50.5 to 47, the quantity of gas obtained was lessened from 61 to 57.5 degrees: also between the 6th and 7th of January, with a diminution of temperature of from 42.5 of the thermometer to 39, there was a diminution of gas of from 51 to 45 degrees. This is what one might, more or less, have expected; but I know not how an increase, and a somewhat considerable one, of the power of the battery could take place under a *diminution* of temperature. Thus, on January 13th, with the thermometer at 32, forty-five degrees of gas were produced; when, on the preceding day, with the thermometer at 36, only 42 degrees of gas were liberated. Again, on the 17th of January, 47 degrees of gas were produced, with the thermometer at 34, when on the preceding day there were only forty-one degrees of gas with the thermometer at 33. The one degree's increase of heat bears no proportion to the six degrees' increase of gas. Again, on the last day of the journal, with the thermometer at 32, there were 4 degrees of gas less than the preceding day with the thermometer at 31. This requires sifting and close examination. It may be observed that the degrees of gas produced on the last day, with the thermometer at 32, and with ice in all the cells, were exactly the same as on the first day with the thermometer at 50. It may also be noted that the total quantity of gas obtained in the fourth week was only 4.5 degrees less than that which was obtained in the third week, notwithstanding the natural diminution of power in the battery, the increased loss by evaporation of fluids, and the five degrees diminution of temperatures. I was prevented from prolonging these observations by the freezing of the water in all the cells. I may here observe, that I had, previously to these experiments, as I have since, tried the effects of heat in combination with voltaic electricity in the formation of crystals, and that I have exposed various solutions under different conditions to the electric action, such solutions having been kept, as nearly as possible, at the boiling point, from one to six weeks, the apparatus being plunged in sand baths, with fires kept up day and night, without a moment's intermission, and the solutions being constantly replaced as they evaporated. In sixteen of these experiments which were carried on at the same time, the evaporation was so great that it exceeded seven gallons in every twenty-four hours. I am not prepared at present to give a succinct account of the different results of these operations, but shall state generally the following conclusions.

1. A piece of yellow sulphuret of copper was exposed to the electric action, in sulphate of copper at the negative pole, *in the cold solution*, and found after a given time to gain a certain weight, the same being my friend Mr. Fox's experiment.

2. A similar piece of the same was exposed, exactly under the same circumstances, *in the hot solution*, to the same electric power, and found to gain *thirty-one times* the weight of the preceding, within the same time. Such additional weight in both cases mostly consisted of metallic crystallized copper and red oxide of copper on the surface of each.

3. Although the solutions in which the latter formation took place, were kept, as constantly as possible, at the boiling temperature, the crystals were generally of the most regular form, with their angles and facets quite as perfect as those of a natural formation.

4. In the production of crystallized copper and red oxide of copper, I found that with a single pair of plates plunged in boiling solutions, the increase of crystallized matter averaged 60 *grains in each day*, or one ounce

troy in every eight days; and that, consequently, even tons weight of crystallized copper and red oxide of copper may be formed in a comparatively very short space of time by an increase of electric power, and the quantity of solutions employed. The sizes of my plates were various, generally about two inches square.

5. By covering large plates of zinc with plaster of Paris, unconnected with any copper plates, and laying them horizontally in large vessels filled with sulphate of copper, kept boiling, and well supplied with a fresh solution as the evaporation went on; the most perfect octohedral crystals of metallic copper and red oxide of copper, were formed to the amount of some ounces in weight in less than ten days. These crystals were fully equal, in all respects, to those formed by nature.

6. The same effects took place in the cold solution, but in an infinitely inferior degree. In this way I have formed crystallized copper, silver, and lead, upon a zinc ingot.

7. In breaking the thick earthen pans, in which some of these formations have taken place, crystals of various sorts are found within their substance. Also veins of metallic copper crossing them in various directions, very similar to what are termed the leaders to a metallic lode. Under some circumstances, perfectly insulated crystals of various sorts, not in connexion with either pole, or with any metallic substance, are formed in abundance. This I have frequently observed, but in much less quantity, to have taken place in the cold solution during the last two years. The above is a correct but rude sketch of some of the general results which I have met with in the combination of heat and electricity.

Query. May it not be possible to apply the combined action of a boiling heat and continued electricity, to the extraction of metals from their ores in a pure state, and with less trouble and expense than the plans now adopted?

London, June 18th, 1838.

Extract from the Journal referred to in the preceding Paper.

Days of the week.	Date.	Of Gas Degre's	Therm.	Days of the week	Date.	Of Gas Degre's	Therm.
	1837.				1838.		
Saturday	Dec. 23	42	50	Friday	Jan. 5	52	44
Sunday	24	64	50	Saturday	6	51	42½
Monday	25	69	50	Sunday	7	45	39
Tuesday	26	67½	50	Monday	8	43	37
Wednesday	27	65½	50	Tuesday	9	41	34
Thursday	28	64	50	Wednesday	10	44½	35
Friday	29	62	51	Thursday	11	44	34
Saturday	30	61	50½	Friday	12	42	36
Sunday	31	57½	47	Saturday	13	45	32
				Sunday	14	42	30½
	1838.			Monday	15	43	33
Monday	Jan. 1	56	47½	Tuesday	16	41	33
Tuesday	2	55½	46	Wednesday	17	47	34
Wednesday	3	54	44	Thursday	18	46	31
Thursday	4	52	42	Friday	19	42	32

Gas obtained.		*Average Temperature.*	
1st week . . .	434°	1st week a little above .	50°
2d do. . . .	388°	2d do. not quite .	46°
3d do. . . .	310½°	3d do. not quite .	37°
4th do. . . .	306°	4th do. a little above .	32°

Annals Electr.

The Barometer in the West Indies.

The following remarks on the barometer result from observations during the last two years, by Mr. J. C. Lees, Chief Justice of Nassau.

The range of the mercury in the barometer (except in storms) is greater in the winter than in the summer months: in the West Indies it neither rises nor falls to any thing like the extent to which it does in Europe, but the fluctuations, though small, are equally to be depended on.

Rain in this climate has but little effect on the barometer, which appears to be operated upon principally by the wind, rising or falling according to the direction from whence it blows. Thus the barometer will be much higher with winds from north to east, accompanied by rain, than when they blow from south to north-west, without rain.

The barometer rises highest when the wind is north-east, and falls lowest when it is north-west.

If during the winter months, say from the beginning of November to the end of March, the wind is steady at north-east, the barometer will stand at about 30 to 30.1 and 30.2; if then the weather becomes squally, and the barometer *rises* much, (say one-tenth of an inch more,) it indicates, as far as I can judge from three instances, a gale or very stiff breeze from the same quarter; this is remarkable, for in all other cases of gales the barometer falls. If with the wind at north-east the mercury falls, the wind will become more easterly; if it continues to fall, it will go round to the south-east, south, and so on to the north-west, which will be its lowest point; in ordinary north-westers about 29.9: but instead of sinking thus gradually, if it falls much, and suddenly, with the wind at north-east, or at any intermediate point from that to south, the probability is, there will be a sudden lull, and the wind will fly round at once to the north-west. If, however, after the mercury has been gradually falling, and at any of these intermediate points it rises again, the wind will, in that case, back to the east or north-east, and will continue there until the mercury has again fallen. When the wind is at north-west, if the mercury continues low, the probability is that it will continue for some time at that point; but if it rises, it is a certain indication that the wind will go to the northward, and continue to rise to the north-east; but if it falls with the wind at north, it will back again to the north-west; if the rise with the wind at north-west is much and rapid, the wind will not remain at north, but will go at once to the north-east.

During the summer months, the winds vary from north-east to south, the prevailing ones being between east and south; the barometer will, therefore, be found to fluctuate between about one-tenth of an inch above, to one-tenth below thirty inches, being highest, as before stated, on the approach, and during the continuance, of north-east winds; and lowest during, or previous to, southerly ones; but there is frequently a very light south wind in the mornings and evenings, extending but a small distance from the shore, which

I take to be of the nature of the land wind of the larger islands, and this wind does not seem to affect the barometer.

When during the hurricane months, the barometer falls much and rapidly, preparations ought to be made for bad weather. Suppose, for instance, standing at 30.2, it were to fall rapidly as low as 29.8, this ought to awaken suspicion; but if it were to fall one or two tenths more, there would be almost a certainty that a heavy gale would in a very short period follow; this fall of the barometer might only be an hour, or half an hour, before the hurricane, but a great deal might be done for the security of vessels or houses in that time.

The barometer, however, gave warning of bad weather several hours previous to the destructive gale of the 27th of October last. The 25th had been cloudy and squally, and at 9 o'clock at night, the barometer fell to 29.72. Next morning, the weather had become clear, but the mercury only rose five-hundredths; at noon, the sky was again overcast, the wind began to freshen from the south-east, and the barometer began again to fall. At 3 o'clock P. M. it was 29.7; that night the gale came on from E. S. E., and continued to blow till next morning about 7 o'clock, when it gradually ceased, and the gale was apparently at an end. But the mercury, which had continued to fall all night, and then stood at 28.87, sank, with fearful rapidity, to 28.5. I had a boat moored in the harbour, but not very securely; when, therefore, I observed the fall of the barometer on the day previous to the gale, I had her better secured, which saved her from the effect of the S.E. gale during the night. When the gale was apparently at an end next morning, I was aware, from the still greater fall of the mercury, that it would soon blow harder than ever. I therefore had the boat, as quickly as possible, hauled up, which saved her from certain destruction, for, as will be remembered, in about an hour afterwards, the gale recommenced with tremendous fury from the north-west. About ten o'clock the mercury began again to rise, and about three hours afterwards the gale began to abate. At 9 P. M. it stood at 29.72, and from that time it continued gradually to rise, as did the gale to moderate. I mention the trifling circumstance of the boat merely as an argument that property of more value might, equally as well, have been saved.

I have already said, that these observations are the result of only about two years' experience, a period too short to afford data for any certain conclusion on such subjects; it is very possible that circumstances may expand or condense the atmosphere, so as to occasion a rise or fall of the barometer, independently of the changes of the wind, or the approach of a gale: or, on the other hand, that a gale might occur without a previous warning from the instrument. I can only, therefore, advise those who have a barometer, on the one hand never to despise its indications of a storm, because the weather appears fine; on the other never to neglect the precautions which an appearance of bad weather would suggest, merely because the barometer had not fallen; it would be better to make unnecessary preparations ever so many times, than to lose valuable property once for the want of them.

Nassau, 12th July, 1838. Naut. Mag.

Aerolites.

The following interesting account of one of these extraordinary phenom-

ena of nature having recently fallen at the Cape of Good Hope, is an extract of a letter from a gentleman residing there, on whose authority the strictest reliance may be placed.

24th Nov. 1838.

"I have taken the liberty to transmit, under your charge, for Sir John Herschel, the accompanying aerolite, or rather a portion of an enormous aerolite, that exploded in the department called the Cold Bokkeveld, about 112 miles N.N.E. of this place, on the morning of the 13th of October, and which, for magnitude, ranks with the largest on record of undoubted authority.

"Judge Menzies, returning from circuit, saw it traversing the atmosphere about 60 miles from the estate where it exploded, with a report equal to the discharge of some pieces of heavy artillery, to the great astonishment of the inhabitants, one of whom had a narrow escape from being destroyed by it.

"I am making strong efforts to secure a piece, said to have made a hole in the ground that would admit a dining table! This may be exaggerated. A man declares the hole is three feet in diameter—also to collect information regarding its velocity—course—altitude, &c.

Another meteor on Wednesday, at 6h. 37m. P. M. (daylight) passed over us. I was sitting with my back to a window, when I was suddenly started by the image of the window frame on the opposite wall, as if the noonday sun was shining through it; at the same instant another person sprang up who was sitting with her face to the window, and saw a body as large as a full moon, descending, and which fell in a S.E. direction from us, at the distance of less than half a mile. There was no noise or explosion.

Two of us immediately started off in the line, but could not discover any thing upon the ground.

It is rather curious that these phenomena should generally happen between September and the latter part of December, which favours the hypothesis of the earth, at the latter part of the year, approaching the orbit of a mass of them circulating round the sun.

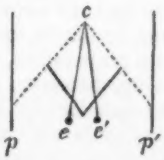
There is a letter from the clergyman at the Bokkeveld, describing the explosion, enclosed to Sir John, with whatever other good authority I could pick up.

Ibid.

On Binocular Vision; and on the Stereoscope, an instrument for illustrating its Phenomena. By Prof. Wheatstone.

Prof. Wheatstone stated, that, at the last meeting of the Royal Society, he had presented the first of a series of papers on the phenomena of vision, in the investigation of which subject he had been for some years engaged. He did not, he said, on the present occasion, intend to enter on the consideration of any of the views and conclusions of that paper, for they related rather to mental, than to physical, philosophy, and they would probably appear in the forthcoming volume of the Philosophical Transactions—he proposed merely to state so much as would enable him to explain the experiments which the apparatus on the table was intended to exhibit. This apparatus he called a Stereoscope, from its property of presenting to the mind the perfect resemblances of solid objects. To understand the principles on which it was constructed, he explained the circumstances which enable us to distinguish an object in relief from its representation on a

plane surface; he showed that when a solid object, a cube for instance, was placed at a short distance before the eyes, its projections on the two retinæ form two dissimilar pictures, which in some cases are so different that even the eye of an artist would with difficulty recognize them as representations of the same object; notwithstanding this dissimilarity between the two pictures, the object is seen single; and hence it is evident that the mind perceives the object in relief, in consequence of the simultaneous perception of the two monocular pictures. He next showed, that if the object were thus drawn, first as it appears to the right eye, and then as it appears to the left eye, and those two pictures be presented one to each retina, in such manner that they fall on the same parts as the projections from the object itself would, the mind perceives a form in relief, which is the perfect counterpart of the object from which the drawings have been taken: the illusion is so perfect that no effort of the imagination can induce the observer to suppose it to be a picture on a plane surface. Prof. Wheatstone described various modes by which the two monocular pictures might be made to fall on similar parts of the two retinæ; but he gave the preference to a method which we will endeavour to explain by means of a diagram.



e e' are the two eyes of the observer placed before two plane mirrors, inclined to each other at an angle of 90°; the axes of the eyes converge to a point *c*; the pictures *p*, *p'*, are so placed on sliding panels, that their reflected images may be adjusted to appear at the place of convergence of the optic axis; it is obvious, then, that the pictures on the retinæ will be precisely the same as if they proceeded from a real object placed at *c*. In this manner may solid geometrical forms, crystals, flowers, busts, architectural models, &c. be represented with perfect fidelity, as if the objects themselves were before the eyes. The law of visible direction, which is universally true for all cases of monocular vision, may, Prof. Wheatstone stated, be extended to binocular vision, by the following rule: that every point of an object of three dimensions is seen at the intersection of the two lines of visible direction, in which that point is seen by each eye singly.

Sir D. Brewster was afraid that the members could scarcely judge, from the very brief and modest account given of this principle, and the instrument devised for illustrating it, by Prof. Wheatstone, of its extreme beauty and generality. He considered it as one of the most valuable optical papers which had been presented to the Section. He observed, that, when taken in conjunction with the law of visible direction in monocular vision, (or vision with one eye) it explains all those phenomena of vision by which philosophers had been so long perplexed; and that vision in three dimensions, which M. Lehot, a French author, had attempted to account for by a very unscientific theory, had received a complete explanation from Mr. Wheatstone's researches.—Sir John Herschel characterized Mr. Wheatstone's discovery as one of the most curious and beautiful for its simplicity, in the entire range of experimental optics. Brit. Assoc—Athenæum.

Cause of Animal Heat.

Dr. J. M. Winn, of Truro, Cornwall, has ascertained that the elastic coat of an artery, when stretched, will give out heat, in the same manner as a piece of caoutchouc. Upon making an experiment with part of the aorta of

a bullock, he felt much gratification in being able to verify his previous conjecture. The experiment was performed in the following manner. Having cut off a circular portion of the descending arch of the aorta, about an inch in length, he laid it open and carefully dissected out the elastic coat, and taking hold of it by each extremity, pulled it to and fro with a continuous jerking motion, (in imitation of the systole and diastole of the artery) for the space of about a minute, when placing it upon the bulb of a thermometer, he had the satisfaction to find, that after it had remained two minutes the mercury had risen as many degrees. On removing the thermometer, the heat immediately began to diminish. To be certain that the heat did not arise from any other source than the one in question, he took the precaution of covering his fingers with a double layer of flannel, to prevent the communication of heat from the body: he also covered his mouth with a handkerchief, to guard against the warm breath affecting the thermometer, whilst watching the progress of the thermometer. It may likewise be stated that the experiment was performed in a room without a fire, the temperature of the air at the time being 55°. There were several difficulties to contend with during the investigation, and it was not until after repeated trials that the experiment succeeded to his satisfaction. The chief impediment, he thinks, must have been owing to the moisture of the artery, which, by its evaporation, must have had a constant tendency to carry off the heat. Having, however, performed the experiment twice consecutively in the same satisfactory manner, he thinks there can be but little doubt entertained as to its conclusiveness. His attention was often arrested, whilst conducting the experiments, by the striking mechanical analogies between caoutchouc and the elastic coat of arteries. Like the latter, it could be elongated to twice its ordinary length, and, on withdrawing the tension, would return to its usual dimension with considerable force and a snapping noise. He was also surprised to find, on slightly drying it, that it would erase black lead pencil marks from paper without leaving a stain. This latter circumstance is perhaps of trifling importance; it serves, however, to show that strong mechanical resemblance may exist between bodies widely differing in their chemical properties.

The doctor regards this experiment, with some plausibility, as accounting satisfactorily for that portion of animal heat which cannot be fairly ascribed to the chemical changes which take place in the lungs. Edin. Philos. Journ.

Note of the Character and Direction of the Electric Force of the Gymnotus.
By Michael Faraday, Esq., D. C. L., F. R. S., &c.

The author first briefly refers to what has been done by others in establishing the identity of the peculiar power in the gymnotus and torpedo with ordinary electricity, and then in reference to the intended conveyance to this country of gymnoti from abroad, gives the instructions which he himself had received from Baron Humboldt for that purpose. A living gymnotus, now in the possession of the proprietors of the Gallery of Science, in Adelaide street, was placed for a time at the disposal of the author, for the purpose of research, upon which he proceeded with suitable apparatus to compare its power with ordinary and voltaic electricity, and to obtain the direction of the force. Without removing it from the water, he was able to obtain not only the results procured by others, but the other electrical

phenomena required, so as to leave no gap or deficiency in the evidence of identity. The shock, in very varied circumstances of position, was procured; the galvanometer affected; magnets were made; a wire was heated; polar chemical decomposition was effected, and the spark obtained. By comparative experiments made with the animal and a powerful Leyden battery, it was concluded that the quantity of force in each shock of the former was very great. It was also ascertained by all the tests capable of bearing on the point, that the current of electricity was, in every case, from the anterior parts of the animal through the water, or surrounding conductors, to the posterior parts. The author then proceeds to express his hope that by means of these organs and the similar parts of the torpedo, a relation as to *action* and *reaction* of the electric and nervous powers may be established experimentally; and he briefly describes the form of experiment which seems likely to yield positive results of this kind. Ibid.

Progress of Civil Engineering.

Engineering Duties of the Birmingham Railway Officers.

The labours of the engineers, it is almost needless to state, commenced long before the ground was broken. In fact, many of them were employed in getting assents to our bill, from the landowners, who have shown themselves so wise in their generation. Then came the various surveys and levellings required for fixing the line; then the designing and drawing of bridges and other works in detail, in order that approximate estimates of costs might be laid before Parliament. When the period arrived for executing the works, it was necessary to calculate the time which those of the greatest magnitude would be likely to occupy, so that they might be let to the contractors in such an order, that the whole might be simultaneously completed, as far as possible, with reference to the successive openings of portions of the whole line, which was desirable, not only as a measure of pecuniary interest, but to get the road in good repair, and to drill every one into his particular duty. The order of letting the contracts having been decided, assistant and sub-assistant engineers were appointed, as required, upon the general principle of dividing the whole line into four districts, and each district into three lengths, so as to place about ten miles under the immediate superintendence of one sub-assistant engineer; thus each assistant engineer had three sub-assistants, being all subordinate to one engineer in chief.

When any particular portion of the works was to be prepared for letting, the sub-assistant engineer, under the direction of his superior, had to revise all the parliamentary surveys and levels with the utmost care, and draw to a large scale very accurate plans and sections of the land, in order that the quantity of excavations and embankments might be obtained as nearly as possible. It was also necessary to make detailed plans and working drawings, elevations, and sections of every bridge and culvert which carried a road or stream across the railway, or which carried the railway over a road or stream. These, being roughly sketched by the engineer on the spot, were sent to the chief office, to be fairly drawn out with full details, and upon a

uniform system laid down by the principal engineer; the object being to put them in such a shape that parties wishing to tender for any of the contracts might clearly understand the nature of the works, and make accurate estimates from the drawings without difficulty. The limits of each contract were defined with reference to the most convenient execution of the works, regard being had to the disposition of the earth works, so that each contractor might make his embankments with the materials yielded by his excavations, as far as it was practicable; care being taken that the aggregate amount of the contract should not exceed the means of the generality of persons in the habit of tendering for such works.

A contract of 100,000*l.* was thought a very responsible undertaking; and the experience of the London and Birmingham Railway has shown that those amounting to, or exceeding, that sum, have called for extraordinary exertions. Of these there have been seven upon the whole line; four were very soon relinquished by the parties originally contracting for them, and the remaining three executed with great difficulty.

The drawings being completed, and the limits of the contracts fixed, detailed specifications were drawn up, under the engineer in chief's superintendence; the whole was then submitted to the inspection of parties willing to tender for the works, who, on an appointed day, delivered in their respective estimates; and the lowest tender was generally, but not invariably, accepted,—regard being always had to the character and means of the parties. The whole of these extensive and important works were let at prices which were under the estimate of the engineer in chief.

The original contract drawings were signed by the engineer in chief and the contractor, and preserved as documents. Three copies of each, however, had to be made out—one for the use of the committee, one for the engineer in chief, and one for the assistant engineer.

When it is borne in mind that the engineering works of the whole railway, in accordance with the above system, were divided into thirty separate divisions, each requiring its own set of drawings, estimates, and specifications, and that all these works, with two unimportant exceptions, were let to various contractors, between May, 1834, and October, 1835, it will be perceived that an extensive and efficient drawing establishment must have been kept at work. Speaking in round numbers, we must say that for eighteen months, not less than thirty drawings per week, each requiring two days' work from one pair of hands, were turned out from the engineer in chief's office.—*Lecount's History of the Birmingham Railway.*

Lond. Mech. Mag.

Plan for Detecting the Displacement of Rails, and of Preventing Accidents on Railways.

Captain Smith, R. N., suggests the following plans for giving additional safety to railway traveling.—For the purpose of detecting the displacement of a rail on any line of road, the policemen stationed for its protection should be desired to pace from one station to the other, once or twice during their watch, drawing after them a *staff along the edge of the rail;* the staff being fitted with a hook on the end, so formed as to *fit the edge of the rail.* It appears to me, that by this simple and unexpensive plan, the slightest derangement would be detected with much greater certainty than if left

to the vision of the men, though aided by a lantern, especially during heavy rain or snow.

The application of this detector would also serve to discover any thing that might be thrown on a rail by design, or driven on it by a powerful gust of wind, &c.

The application of the plan would ensure the patrolling of the line of road from one end to the other, the men being desired to pass each other a few yards before they return to their station box, which they should do by the other rail, drawing the staff or detector after them, as on the first. The men might be required to exchange their staff, (which should be numbered) as a proof they had communicated with each other on their beat.

I ventured to suggest, some time since, that a gong might be used to advantage, if attached to the *last* carriage in each train, to be struck for the purpose of warning a train that might be expected to overtake one that was detained on the road by accident or otherwise.*

I am aware that powerful lights are used for these purposes; but as fogs are occasionally exceedingly dense, and people's eyes are not always open, I feel assured that the sound of a powerful gong would be found much more useful in peculiar cases—and it might also be used as a means of calling the attention of the engineer, should the guard at the opposite end of a train require to do so, in the event of a separation in the train, or other casualty.

It is also suggested for consideration, that in order to enable the trains to run without loss of time when the rails are slippery, that the engine should be fitted with a box or compartment to contain sand, from which two pipes should lead before the first wheels, and immediately over the rails, to be arranged so that the engineer could with ease cause sand to be sprinkled lightly on the rails, whenever he found them too slippery to proceed as fast as he wished. The sand to escape on the principle by which some seeds are sown. The first or the last carriage might brush the sand off (if thought requisite) as it followed the engine, to prevent the rails being unnecessarily worn by the increased friction. [The use of sand, &c. has been already suggested by Col. Maceroni.] Ibid.

Experiments on the Power of Men. *By* Joshua Field, V. P. Inst. C. E., F. R. S.

In this paper are recorded the results of some experiments made to ascertain the working power of men with winches, as applied to cranes. The experiments were undertaken with a view of ascertaining the effect men can produce working at machines or cranes for short periods, as compared with the effect which they produce working continuously.

The apparatus, a crane of rough construction in ordinary use, and not prepared in any manner for the experiments, consisted of two wheels, of 92 and 41 cogs, and two pinions, of 11 and 10 cogs; the diameter of the barrel, measuring to the centre of the chain, was 11¾ inches; and the diameter of the handle 36 inches. The ratio of the weight to the power on this combination is 105 to 1.

* An accident occasioning the loss of *lives*, is just announced in the papers as having occurred in America, in consequence of a dense fog.

The weight was raised in all cases through 16½ feet, and so proportioned in the different experiments, as to give a resistance against the hands of the men of 10, 15, 20, 25, 30, and 35 lbs., *plus* the friction of the apparatus.

* * * * *

In order to compare these experiments with each other, these results must be reduced to a common standard of comparison, and it is very convenient to express the results of such experiments by the pounds raised one foot high in one minute, this being the method of estimating horses' power. The number is in each case obtained in the following manner. I will take the first experiment.

Here 1,050 lbs. was raised 16½ feet high in 90 seconds; this is equivalent to (1,050 × 16.5) = 17,325 lbs. raised one foot high in 90 seconds, which is equivalent to (17,325 ÷ 1.5=11,550 lbs. raised one foot high in one minute. In this case, then, the man's power = 11,550.

The same calculations being pursued in the other cases, give the nnmbers constituting the last column of the following table:—

No. of Experiment.	Statical resistance at handle.	Weight raised.	Time in seconds.	Time in minutes.	Remarks.	Man's power.
I.	10	1050	90	1.5	Easily, by a stout Englishman, . . .	11550
II.	15	1575	135	2.25	Tolerably easily, by the same man . . .	11505
III.	20	2100	120	2	Not easily, by a sturdy Irishman . . .	17325
IV.	25	2625	150	2.5	With difficulty, by a stout Englishman .	17329
V.	30	3150	150	2.5	With difficulty by a London man . .	20790
VI.	35	3675	132	2.2	With the utmost difficulty by a tall Irishman	27562
VII.	..	..	150	2.5	With the utmost difficulty, by a London man, same as Experiment V. . .	24255
VIII.	..	..	170	2.83	With extreme labour, by a tall Irishman .	21427
IX.	..	..	180	3	With very great exertion, by a sturdy Irishman, same as Experiment III. . .	20212
X.	..	..	243	4 05	With the utmost exertions, by a Welshman	15134
XI.	.	..		. . .	Given up, at this time, by an Irishman .	.....

We may consider experiment IV. as giving a near approximation to the maximum power of a man for two minutes and a half; for in all the succeeding experiments the man was so exhausted as to be unable to let down the weight. The greatest effect produced was that in experiment VI. This, when the friction of the machine is taken into the account, is fully equal to a horse's power, or 33,000 lbs. raised one foot high in one minute. Thus, it appears, that a very powerful man, exerting himself to the utmost for two minutes, comes up to the constant power of a horse, that is, the power which a horse can exert for eight hours per day.—*Trans. Inst. C. E.* Ibid.

We should be glad to see the experiments of the above table extended to a complete dozen, by the trial of a good Yankee or a big boned Kentuckian.

G.

Oxford Street Experimental Pavement.

The importance of ascertaining the best species of pavement for the car-

riage roads of the metropolis is some excuse for the confusion, accompanied by the smoke and offensive odours from the caldrons, which have prevailed at the east end of Oxford street for the last two months. The inhabitants have, however, been great sufferers thereby; but we now congratulate them, that, at last, all the ground is assigned and set out for the different varieties, while many of them are completed, and the rest are in progress. Commencing at Charles street are the *asphaltum blocks of Robinson*, one half laid straight, the other diagonally. This is followed by *granite pavement*, nine inches deep, jointed with Claridge's asphaltum; then is to succeed a granite pavement of stones, only four and a half inches deep, also to be joined with the same substance, Mr. Claridge being of opinion, and desirous of proving, that his cement is sufficiently strong to bind even these shallow stones into one solid mass. To this succeeds the *Bastenne Company's* portion; the blocks in this part are in the form of bricks, but somewhat larger; they have been laid both ways, straight and diagonally. Next follows the *granite pavement*, laid by the parish, which is undoubtedly one of the finest specimens of work of its kind to be found in London. It consists of three parts:—1. Stones laid in the ordinary way, on a well formed bed of concrete. 2. Similar stones laid diagonally on a bed of the same material; the joints of both these portions are filled with a grouting of lime, sand, &c. 3. Stones laid in the usual manner, but on the earth, without any official bed, and the joints are filled in with fine gravel. The whole of this work has a good curved surface, and the regular thickness of the stones has evidently been carefully attended to. The next experiment, going towards Tottenham court road, is what is called the *Scotch asphaltum granite*, (said to be a patented article.) This composition has the appearance of stone, and the blocks are about six inches thick, nine inches broad, and eighteen inches long on one face, while the other is only thirteen inches long. In laying them, (which is done with Parker's cement) every alternate block is reversed, so that every second block lies solid on its base, or longest face, while the others fit in between them as keystones, and when joined, each may be said to support the other. The next division is the *wood pavement*, composed of blocks of fine timber, Kyanized; they are of a hexagonal form, seven inches diameter, and fifteen inches deep, part is laid on a bed of one and a half inch planks. Then follows the *Val de Travers asphalte*, which will occupy the remaining portion of the street devoted to experimental pavement. This last article consists of blocks, about ten inches square and five inches thick, formed of a bitumen thickly studded by broken pieces of granite; so that, when laid, it may be looked upon as a sort of macadamized road, where, in lieu of earth, for filling the interstices between the broken granite, and making the whole of a solid mass, a strong binding composition has been employed.—*C. E. & Arc. Journ.* Ibid.

Supplying St. Pancras with Water from Artesian Wells.

We have been much surprised to see by the newspapers that this subject has been seriously thought of, and discussed in meetings, at which some persons were present eminent for scientific knowledge. We thought it had been generally known that the sources which supply the London basin, ample as they are, are still limited. As a practical proof of this, it is only necessary to mention that the two great breweries which draw their supplies

from wells which penetrate to the chalk, the one on the Middlesex, and the other on the Surrey side of the river, cannot both pump on the same day, and, by agreement, pump on different days. If a part of the Thames water above Richmond, where it is tolerably pure, could, by means of a deep shaft, be made to run into the basin, then, no doubt, the whole of London might be supplied from it, cheaper than is now done by surface pipes. But, supposing this mode to be adopted, it would only prove sufficient for a century or two; for such would be the quantity of sand and mud carried down by the water of the Thames, that, unless it were filtered before it entered the shaft, it would, in time, solidify the under stratum. Among all the plans that have been devised for supplying London with water, we have no doubt whatever that the present mode, by surface pipes, is the best, provided the water be drawn from pure sources. By being brought in in pipes covered by earth, the water is delivered at a lower temperature in summer, and a higher temperature in winter, and free from all those impurities to which an open water course is liable: witness, for example, the New River. How to induce the public companies to supply water at moderate rates, is a different question. Perhaps the real object of the St. Pancras meeting was to hold the Artesian system *in terrorem* over the advocates of the surface system, in order to keep the water companies within bounds.—*Mr. Loudon—Arch. Mag.*

Ibid.

Nuremberg Railway.

The third anniversary of the opening of the railway from Nuremberg to Fürth, has just been celebrated. Since the 7th of December, 1835, no less than 1,557,285 passengers have been conveyed on this railway, though the population of both towns between which it runs does not exceed 60,000. This makes seven journeys each year for each inhabitant,—an astonishing result. During those three years no life has been lost on the railway, no serious accident of any kind has occurred, and the railway has received no material injury.

Ibid.

Austrian Railroads.

The rails in the Austrian railroads are now made of Iron from Styria, which are said to be found more durable than those supplied from England.

Ibid.

Mechanics' Register.

Submarine Volcano.

On the 25th of last November, the captain and passengers of the brig Cæsar, from Havre, on passing the bank of the Bahama, saw an enormous fire, which increased till it had tinged the whole of the sky, and part of the horizon. It was kept in sight for four hours, and could only be accounted for as proceeding from a submarine volcano. On the 3d of January, the captain of the Sylphide, also from Havre, being on the same spot, found the sea disturbed, and whitish in colour, which he attributed to the same cause. To these notices, conveyed to the French Academy of Sciences,

M. Moreau de Joannes adds, that on the 30th of the same December, an earthquake took place at Martinique. The shock was violent, and the heat very great. Naut. Mag.

Joyce's Apparatus for Heating by Steam.

A mode of heating a small greenhouse by steam from a portable apparatus placed within the house, has lately been invented by Mr. Joyce. The apparatus is a copper cylinder, with the fire placed in the centre, the fuel being supplied from the top, and the ashes coming out below, through the grating which admits air to the fire. The fuel is charcoal, and the little smoke which it produces is delivered into the same tube which conveys away the steam. At the further extremity of the steam pipe, the fumes of the charcoal are allowed to escape outside the house, through a tube, which, for ordinary apparatus, need not exceed an inch in diameter. As the steam pipe is placed so as to return all the condensed water to the boiler, the loss of heat by this mode is extremely small, but it will not answer well for any other fuel except charcoal, which is expensive.—*Loudon's Suburban Gardener.* Lond. Mech. Mag.

Chaplin's Non-elastic Leather Bands.

A method has at length been discovered of manufacturing leather, for machine straps or bands, which is nearly, or quite, free from any tendency to stretch. This is accomplished by the new method of tanning, which lately attracted some notice in the pages of the Mechanics' Magazine, and of which Mr. Chaplin is the inventor. The hide, in its elastic state, before it is tanned, is made into a bag, by sewing the edges together, and filled with tanning liquor, the pressure of which forces it through the pores, so that it comes out on the other side, leaving the tannin which it contained in combination with the hide—the result sought by the tanner. In this way the hide is, of course, completely opened and extended, and kept so during the whole process; so that, when the leather is afterwards subjected to strain or pressure, very little further extension can be obtained. Ibid.

Great Seal of England.

Her Majesty's new great seal is a most beautiful specimen of art, and reflects the highest credit on the talent, skill, and professional taste of the artist;—Obverse: an equestrian figure of her Majesty, attended by a page. The queen is supposed to be riding in state; over a riding habit she is attired in a large robe, or cloak, and the collar of the order of the garter; in her right hand she carries a sceptre, and on her head is placed a royal tiara or diadem. The attendant page, with his hat in his hand, looks up to the queen, whilst gently restraining the impatient courser, which is richly decorated with plumes and trappings. The inscription, "Victoria, Dei Gratia Britanniarum Regina, Fidei Defensor," is engraved in Gothic letters, and the spaces between the words are filled with heraldic roses.—Reverse: the queen, royally robed and crowned, holding in her right hand the sceptre, and in her left the orb, is seated upon the throne, beneath a rich Gothic canopy; on either side is a figure of Justice and Religion; and in the ex-

ergue are the royal arms and crown; the whole encircled by a wreath or border of oak and roses. Lond. Journ.

On the Expansive Action of Steam in Cornish Engines. By W. J. Henwood.

At the commencement of this paper, the author describes, with great detail, the action of the indicator, and the nature of the evidence which it furnishes on the working of an engine. The author then states the results arrived at on applying the indicator to the cylinders of some of the best engines in Cornwall. The peculiar circumstances of each case, as the cloth-ing of the boilers, steam pipes, and the various methods adopted for keep-up the temperature of the cylinder, are detailed. The steam cases or jackets of some of the engines, were filled with dense steam from the boilers of others with heated air. The dimensions of the working parts and the loads of the engines, the water and steam in the boilers, the temperatures of the hot well of the condensing water, of the boiler shed, engine house, and external air; the duration of the experiments; the coals consumed, according to weight and measure; the quantity of oil and grease; the number of strokes; the duration of each experiment, and the pressures of the boiler and cylinder are tabulated for the respective engines.

The greatest duty performed by the measured bushel, by 84 lbs. damp, and by 84 lbs. dry, is respectively $86\frac{1}{2}$, $72\frac{1}{2}$, and $77\frac{1}{2}$ millions.

This paper also contains a calculation, as to the expense of performing a given quantity of work, and it appears that, a proper allowance being made for the coal, grease, and oil consumed, there was raised by Huel Towan engine, 1085 tons, and by Binner Downs 1006 tons, one foot high for one farthing. According to this result, the weight of a man ($1\frac{1}{2}$ cwt.) would be raised ten miles for a penny. Ibid.

On the Dry Meter. By S. Clegg.

The instrument originally designed for measuring gas, may be applied to other useful purposes, as to register the average pressure of high pressure steam, the average temperature of heated air, or the average of any variable temperature for any period. The principle of action in this instrument, is the evaporation of spirits of wine, which is well known to vary *directly* as the heat. The spirit of wine is contained in a pulse glass, the connecting stem being bent round, so that the two bulbs are brought nearly into contact with each other; the glass revolves about an axis perpendicular to its plane, the axis being so placed, that when the upper glass is filled with the spirit, the centre of gravity should be a little beyond the vertical, through the point of suspension, and, consequently, the upper bulb descends. In the frame-work of the instrument are two orifices, opening directly on the upper and lower bulbs, but of different areas, the lower orifice being somewhat the larger: through these orifices, currents of gas are passed by means of tubes, the gas having been previously conducted to the under side of a gas burner, so that the gas in its passage may be heated. It is then ascertained by actual experiment, what quantity of heated gas will cause the spirits from the lower globe to be driven into the upper one: this, once ascertained, may be always depended upon. The spirit of wine having ascended from the lower

to the upper globe, the descent of the upper one gives motion to wheel work, whereby the number of these oscillations, and consequently the number of volumes of heated gas which have passed through the tubes, may be registered. Ibid.

Enormous Plate of Iron.

We were lately shown, in Messrs. Fawcett, Preston & Co.'s yard, two plates of iron, which are said to be the *largest ever made.* They measure 10 feet 7 inches long, 5 feet 1 inch wide, and 7-16ths of an inch thick, and weigh between 7 and 8 cwt. They are intended for the bottom plates of two steam generators, on Mr. Howard's plan, and were made by the Colebrookdale Iron Company, Shropshire; who, we were informed, are the only company in Britain (we may say in the world) that can make plates of this size, or even approaching to it.—*Liverpool Standard.* Lond. Mech. Mag.

Patent Safety Fuse.

The patent safety fuse, noticed and recommended in this Journal, is now manufactured at Simsbury, Hartford county, Conn. Agents for the sale of it are Curtis & Hand, 16 Commerce street, Philadelphia; Pratt & Keith, South Charles street, Baltimore; G. B. Peake, Richmond, Va.; and W. B. Peake, Fredericksburg, Va. G.

Easy Receipt to Make Vinegar.

One pound of coarse brown sugar to a quart of water; boil them together, taking off the scum; when that ceases to rise, pour off the liquor; and when it has cooled down to the same temperature as beer in the process of brewing, throw in a piece of hot toasted bread, spread with yeast. In twenty hours put the whole into an iron hooped barrel, placed near a fire; or in summer, where it may have the heat of the sun the greater part of the day. The barrel must not be bunged up, only place a tile, or any thing else that will keep out dust and insects, over the bung hole. In three months, or sometimes less, the vinegar will be clear and fit for use; it should then be bottled off, and the longer it is kept in bottle the better it will be.—*Labourer's Friend.* Lond. Farm. Mag.

A Transparent Watch.

A watch has been presented to the Academy of Science, at Paris, constructed of very peculiar materials, the parts being principally formed of rock crystal. It was made by M. Rebellier, and is small in size. The internal works are visible; the two teethed wheels which carry the hands are rock crystal, the other wheels of metal, to prevent accidents from the breaking of the springs. All the screws are fixed in crystal, and all the axles turn on rubies. The escapement is of sapphire, the balance wheel of rock crystal, and its springs of gold. The regularity of this watch as a time keeper is attributed, by the maker, to the feeble expansion of the rock crystal in the balance wheel, &c. The execution of the whole shows to what a state of perfection the art of cutting precious stones has been carried in modern times. Lond. Mech. Mag.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JUNE, 1839.					Angles reckoned to the right or westward round the circle, as seen in an inverting telescope. ☞ For direct vision add 180° ☜	
Day.	H'r.	Min.	Star's name.	Mag.	from Moon's North point.	from Moon's Vertex.
20	7	59	Im. 68 i Virginis	,5,	84°	93°
20	9	13	Em.		203	228
21	11	0	Im. 1617 Baily Virginis	,6,	92	126
21	12	10	Em.		221	264
23	8	50	Im. b Scorpii	5	75	239
23	10	20	Em.		65	248
30	9	59	Im. 45 D Aquarii	6	89	39
30	10	56	Em.		317	271

Meteorological Observations for December, 1838.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
☉	1	29	41	29.83	29.70	W.S.W.			Lightly cloudy—do. do.
	2	36	46	60	60	S.W.W.			Cloudy—do.
	3	24	31	95	30.01	W.			Clear—do.
	4	27	32	30.15	14	E.			Cloudy—flurry of snow.
	5	33	35	29.90	29.70	W.S.		.05	Drizzle—do.
	6	34	38	56	56	W.			Clear—lightly cloudy.
	7	22	39	70	65	W			Clear—cloudy.
☽	8	32	38	50	52	S E W.		.08	Snow—clear.
	9	19	24	30.00	30.06	W.			Clear—do.
	10	14	22	15	15	W.			Clear—cloudy.
	11	29	43	29.95	29 81	N S W.			Cloudy—clear.
	12	34	43	65	80	S.W.W.			Clear—do.
	13	16	28	30 26	30.26	N S E.			Clear—do.
	14	30	36	05	29 90	N.E.			Cloudy—do.
⊗	15	32	48	29.84	84	W.			Clear—do.
	16	29	28	30.05	30.15	W.N.W.			Cloudy—lightly do.
	17	18	29	10	10	E.		.25	Cloudy—snow
	18	30	42	29.60	29.60	W.			Cloudy—partially do.
	19	32	35	70	75	W.			Partially cloudy—clear.
	20	24	28	80	85	W.			Clear—flying clouds.
	21	28	37	56	53	S.W.W			Cloudy—flying clouds.
	22	32	41	40	40	S.W.W.			Cloudy—do.
☾	23	31	21	40	40	W.			Cloudy—clear.
	24	12	22	30.05	30.05	W.			Clear—do.
	25	14	33	00	00	W.S.W.			Clear—do.
	26	28	30	29.91	29.40	W.			Cloudy—clear.
	27	17	23	30.05	30.06	N.W.			Clear—do. [night.
	28	11	27	29.25	25	W.S.		.54	Clear—lightly cloudy—snow in
	29	29	28	45	29 70	N.W.			Cloudy—do.
☉	30	8	19	30.50	30.60	W.			Clear—do.
	31	10	24	45	45	W.			Clear—do.
	Mean	24.64	33 03	29 85	29.87			0.92	

	Thermometer.	Barometer.
Maximum height during the month.	48. on 15th.	30.60 on 30th.
Minimum " " "	8. 30th.	29.25 28th.
Mean	28.838	29.861

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

APRIL, 1839.

	County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barom. 7, A. M.	2, P. M.	9, P. M.	Maximum.
1	Philadelphia,	Philadelphia,	J. P. Espy.	47.22	64.75	52.65	81.	34.	54.87	1/3	33.	44.35	.	29.97	29.95	29.94	30.30
2	Montgomery,																
3	Bucks,	Newtown,	L. H. Parsons.	54.70	63.47	55.80	76.	33.	57.99	3 2/3	....	.....	.	29.98	29.99	29.97	30.31
4	Lehigh,																
5	Northampton,	Easton															
6	Monroe,	Stroudsburgh,	A. M. Stokes.	42.37	63.38	49.11	79.	26.	51.62	1	.....	.....	.	29.53	29.51	29.50	29.86
7	Pike,																
8	Wayne,																
9	Susquehanna,	Silver Lake,	E. Rose.	46.97	61.57	53.77	78.	34.	54.10	.	28.	41.93	.	28.05	28.05	28.05	28.32
10	Luzerne,																
11	Schuylkill,	Pottsville,	John Porter.	43.99	60.93	50.51	77.	34.40	51.81	1	23.	38.30	.	29.21	29.15	29.19	29.50
12	Berks,	Reading,	C. F. Egelman.	45.70	60.90	52.37	76.	33.	52.99	.	....	.....	.	29.76	29.73	29.75	30.05
13	Chester,	West Chester															
14	Delaware,	Haverford,															
15	Lancaster,	Lancaster,	Conservatory of Arts,	47.04	64.67	53.27	78.50	31.50	54.99	.	29.50	43.17	.	29.49	29.47	29.47	29.81
16	York,	York															
17	Lebanon,																
18	Dauphin,																
19	Northumberland	Northumberland,	Andrew C. Huston.	49.61	64.23	52.17	77.	38.	55.34	.	24.	37.87	.	29.45	29.41	29.41	29.76
20	Columbia,	Danville,															
21	Bradford,																
22	Tioga,																
23	Lycoming,																
24	Union,	New Berlin															
25	Mifflin,	Lewistown,	J. Culbertson, M. D.	48.24	63.99	58.45	74.	34.50	56.89	5	....	.....	.	29.35	29.29	29.42	29.58
26	Juniata,	Mifflintown,	Andrew Parker.	53.43	61.33	59.41	71.	41.	58.12	1/3	40.	51.82	2	29.64	29.64	29.64	29.90
27	Perry,	New Broomfield															
28	Cumberland,	Carlisle,	Prof. W. H. Allen.	48.50	63.10	52.70	75.	32.	54.77	1/3	28.	40.10	.	29.42	29.36	29.37	29.72
29	Adams,	Gettysburgh,	Prof. M. Jacobs.	46.43	64.04	52.02	77.25	31.50	54.16	.	26.50	41.69	.	29.46	29.45	29.42	29.79
30	Franklin,	Chambersburgh,															
31	Huntingdon,																
32	Centre,	Bellefonte,	John Harris.	40.01	66.96	49.67	83.	23.	52.21	1	10.	33.34	4	29.26	29.20	29.23	29.54
33	Potter,																
34	M'Kean,	Smithport,	Richard Chadwick.	39.13	59.83	45.50	78.	28.	48.15	.	22.	33.00	.	29.52	29.74	29.65	30.34
35	Clearfield,																
36	Cambria,																
37	Bedford,																
38	Somerset,																
39	Indiana,																
40	Jefferson,	Rose Cottage,	Charles C. Gaskill.	38.37	66.07	48.67	80.	26	51.04	.	24.	38.03	.	29.13	29.12	29.09	29.90
41	Warren,																
42	Venango,																
43	Armstrong,																
44	Westmoreland,																
45	Fayette,																
46	Green,																
47	Washington,	Canonsburgh															
48	Alleghany,																
49	Beaver,																
50	Butler,																
51	Mercer,																
52	Crawford,	Meadville,	William Reynolds.	43.30	68.27	48.70	86.	28.	53.42	.	23.	41.20	.	28.74	28.73	28.71	28.99
53	Erie,	Erie															

LUN	rmometer.						Barometer.									
				Register.												
	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Rain.
Day.	34.	54.87	$\frac{1}{3}$	33.	44.35	.	29.97	29.95	29.94	30.30	29.29	29.95	.	$17\frac{1}{3}$	$12\frac{2}{3}$	....
20	33.	57.99	$3\frac{2}{3}$	....	.....	.	29.98	29.99	29.97	30.31	29.38	29.98	7	7	$9\frac{2}{3}$	....
20																
21	26.	51.62	1	.....	.....	.	29.53	29.51	29.50	29.86	29.	29.51	$\frac{2}{3}$	$17\frac{2}{3}$	11	6
21																
23																
23	34.	54.10	.	28.	41.93	.	28.05	28.05	28.05	28.32	27.60	28.05	.	$18\frac{1}{3}$	$11\frac{2}{3}$	3
30																
30	34.40	51.81	1	23.	38.30	.	29.21	29.15	29.19	29.50	28.73	29.18	$\frac{2}{3}$	$21\frac{1}{3}$	8	2
	33.	52.99	.	....	.....	.	29.76	29.73	29.75	30.05	29.15	29.74	.	$15\frac{2}{3}$	$14\frac{1}{3}$	5
)	31.50	54.99	.	29.50	43.17	.	29.49	29.47	29.47	29.81	28.88	29.48	.	$16\frac{2}{3}$	$13\frac{1}{3}$	4
	38.	55.34	.	24.	37.87	.	29.45	29.41	29.41	29.76	29.89	29.43	.	$15\frac{2}{3}$	$14\frac{1}{3}$	10
Moon.																
☉	34.50	56.89	5	....	.....	.	29.35	29.29	29.42	29.58	28.86	29.35	6	$15\frac{2}{3}$	$7\frac{1}{3}$	5
	41.	58.12	$\frac{1}{3}$	40.	51.82	2	29.64	29.64	29.64	29.90	29.44	29.64	$\frac{1}{3}$	.	.	6
	32.	54.77	$\frac{1}{3}$	28.	40.10	.	29.42	29.36	29.37	29.72	28.83	29.38	$\frac{1}{3}$	$17\frac{2}{3}$	12	5
5	31.50	54.16	.	26.50	41.69	.	29.46	29.45	29.42	29.79	28.86	29.44	.	19	11	7
☽	23.	52.21	1	10.	33.34	4	29.26	29.20	29.23	29.54	28.78	29.23	1	$15\frac{1}{3}$	$13\frac{2}{3}$	....
	28.	48.15	.	22.	33.00	.	29.52	29.74	29.65	30.34	29.15	29.64	.	20	10	....
⊗	26	51.04	.	24.	38.03	.	29.13	29.12	29.09	29.90	28.18	29.11	.	$22\frac{1}{3}$	7	....
☾																
☉																
M																
Maximum Minimum Mean	28.	53.42	.	23.	41.20	.	28.74	28.73	28.71	28.99	28.31	28.73	.	19	11	4

Weather.								Winds.																Hygrometer.					
Clear.	Cloudy.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	Days omitted.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
17 1/3	12 2/3	....	....	....	..	....	...	1 2/3	2 1/3	2	.	1 1/3	.	1/3	.	3 2/3	2	2	1 2/3	1 1/3	.	3 1/3	1 1/3	3 1/3	4	....	.	.....	53.76	1	728
7	9 2/3	....	...	....	..	3.200	13 2/3	.	.	9 2/3	.	.	.	1 2/3	.	1/3	.	6	.	2/3	.	3	.	.	8 2/3	....	.	.....	....	.	796
17 2/3	11	6	....	....	..	5.805	1 1/3	3 1/3	.	4 1/3	.	2 2/3	.	3 2/3	.	1	.	6 1/3	.	2 1/3	.	5 2/3	.	.	2/3	....	.	.....	58.05	1	726
18 1/3	11 2/3	3	....	....	..	4.000	.	.	.	.	.	.	.	.	.	5 1/3	1/3	7 1/3	2/3	7	2 2/3	6	1/3	.	.	....	.	.....	....	.	727
21 1/3	8	2	....	2	.	3.102	2/3	3	.	2/3	.	2/3	.	7 1/3	.	2/3	.	2	.	2	.	6 2/3	1/3	6 1/3	1/3	....	.	.....	....	.	714
15 2/3	14 1/3	5	2	...	1	3.200	.	4	.	3 1/3	.	2 1/3	.	2 2/3	2/3	.	.	5	.	3 1/3	.	8 1/3	1/3	.	.	....	.	.....	....	.	713
16 2/3	13 1/3	4	2	....	1	6.030	.	3	1 2/3	4 1/3	.	2 1/3	.	1/3	.	3 1/3	3	3 1/3	1/3	1	1/3	5 1/3	1 1/3	.	1/3	43.62	.	.....	54.02	.	724
15 2/3	14 1/3	10	....	....	..	4.634	.	4 2/3	2/3	3 1/3	2/3	1 2/3	1/3	3	1 1/2	2 1/3	1	1 2/3	.	2	.	3	1 1/3	3 1/3	.	....	.	.....	57.70	.	711
15 2/3	7 1/3	5	....	....	1	....	7	.	.	6 1/3	.	.	.	1 2/3	1/3	.	4 2/3	3 2/3	.	.	.	2 1/3	.	.	11	....	.	.....	....	.	735
.	.	6	....	....	..	....	.	5 1/3	.	3 1/3	.	1 1/3	.	5	.	3	.	1 1/3	.	5	.	5 2/3	.	.	.	....	.	.....	....	.	712
17 2/3	12	5	....	....	1	....	1/3	2/3	1 1/3	2 1/3	1	2/3	.	1 2/3	1	2 1/3	.	2 1/3	1 2/3	1 2/3	1/3	5 1/3	1/3	7	1/3	38.68	3	....	51.	3	723
19	11	7	....	....	3	2.399	.	3 1/3	.	4 1/3	1/3	2 1/3	.	1	1	3 2/3	2	3 2/3	.	2	.	4	1/3	1 2/3	2/3	42.35	.	21.69	53.30	.	718
15 1/3	13 2/3	....	....	....	..	2.568	1	1	1/3	3	1/3	1	.	5	1/3	3 2/3	1/3	4 2/3	1/3	1 2/3	1 1/3	2 2/3	.	.	1 1/3	....	.	.....	....	.	756
20	10	....	....	....	..	1.461	.	1/3	.	.	.	2 1/3	.	7	.	.	1/3	2 1/3	.	7	.	2	.	8 2/3	.	57.28	4	.....	57.21	2	732
22 1/3	7	....	....	....	..	1.070	1/3	1 1/3	.	.	.	.	.	1/3	.	.	.	2/3	.	1 2/3	1/3	2	.	23	2/3	40.23	.	.....	56.23	.	729
19	11	4	1	....	4	1.792	.	1	2/3	2/3	.	2/3	6 2/3	1/3	.	.	1 2/3	1	1/3	1/3	2/3	1	2 1/3	2/3	12	.	....	.	.....	....	.	720